

# Hitachi Air Circuit Breakers AKH, AKS, AKN series



# **Air Circuit Breakers**

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Premium ACB meets your demands for high breaking capacity, fully line-up, and optimized panel size. Various accessories and connection methods realize user-friendly handling.

ACB provides you with total solutions with an advanced trip relay for measurement, diagnosis, analysis, and communication as well as protective functions for absolute protective coordination and electric power monitoring system.

# Full line-up & Compact

Up to 6300A, ACB provides fully lined-up 3 frame. For each frame, there is just one size, which is smaller and more compact. It makes it possible for you to design the optimized volume panel.



85kA ..... 100kA ..... 150kA

### AKH-06 – 20D

|    |        |
|----|--------|
| 06 | 630AF  |
| 08 | 800AF  |
| 10 | 1000AF |
| 13 | 1250AF |
| 16 | 1600AF |
| 20 | 2000AF |

I<sub>cu</sub> = I<sub>cs</sub> = 85kA/500Vac  
W = 334(3p), 419(4p)mm

### AKH-06 – 40E

|    |        |    |        |
|----|--------|----|--------|
| 06 | 630AF  | 20 | 2000AF |
| 08 | 800AF  | 25 | 2500AF |
| 10 | 1000AF | 32 | 3200AF |
| 13 | 1250AF | 40 | 4000AF |
| 16 | 1600AF |    |        |

I<sub>cu</sub> = I<sub>cs</sub> = 100kA/500Vac  
W = 412(3p), 527(4p)mm

- The highest breaking capacity: 150kA (6300AF at 500VAC)
- 3 ampere frame sizes: 2000/4000/6300AF
- N phase current conducting capacity: 100%

### AKH-40 – 63G

|    |        |
|----|--------|
| 40 | 4000AF |
| 50 | 5000AF |
| 63 | 6300AF |

I<sub>cu</sub> = I<sub>cs</sub> = 150kA/500Vac  
W = 785(3p), 1015(4p)mm

# Trip relay



**N type**

- L/S/I/G/Thermal
- Self Power
- RTC Timer mounted
- Fault information (LED)



**A type**

- L/S/I/G/Thermal
- ZSI
- Remote Reset
- Modbus/RS-485
- Profibus-DP
- Self Power
- AC/DC 100 – 250V
- DC 24 – 60V
- RTC Timer mounted
- Fault Recording (10EA)



**P/S type**

- L/S/I/G/Thermal (Continuous)
- US/OV/OF/RF/rP/Vun/Iun
- Measurement: V/A/W/Wh/F/PF
- Harmonics (63th), Waveform (S Type)
- ZSI
- Remote Reset
- Modbus/RS-485
- Profibus-DP
- AC/DC 100 – 250V
- DC 24 – 60V
- RTC Timer mounted
- Event Recording (256EA)
- Fault Recording (256EA)
- Fault Wave (S Type)

## Trip relays series



**N Type (Normal)**  
• Self-power + Current protection



**P Type (Power Meter)**  
• A type + Power Meter +  
Voltage/Frequency/Unbalance protection

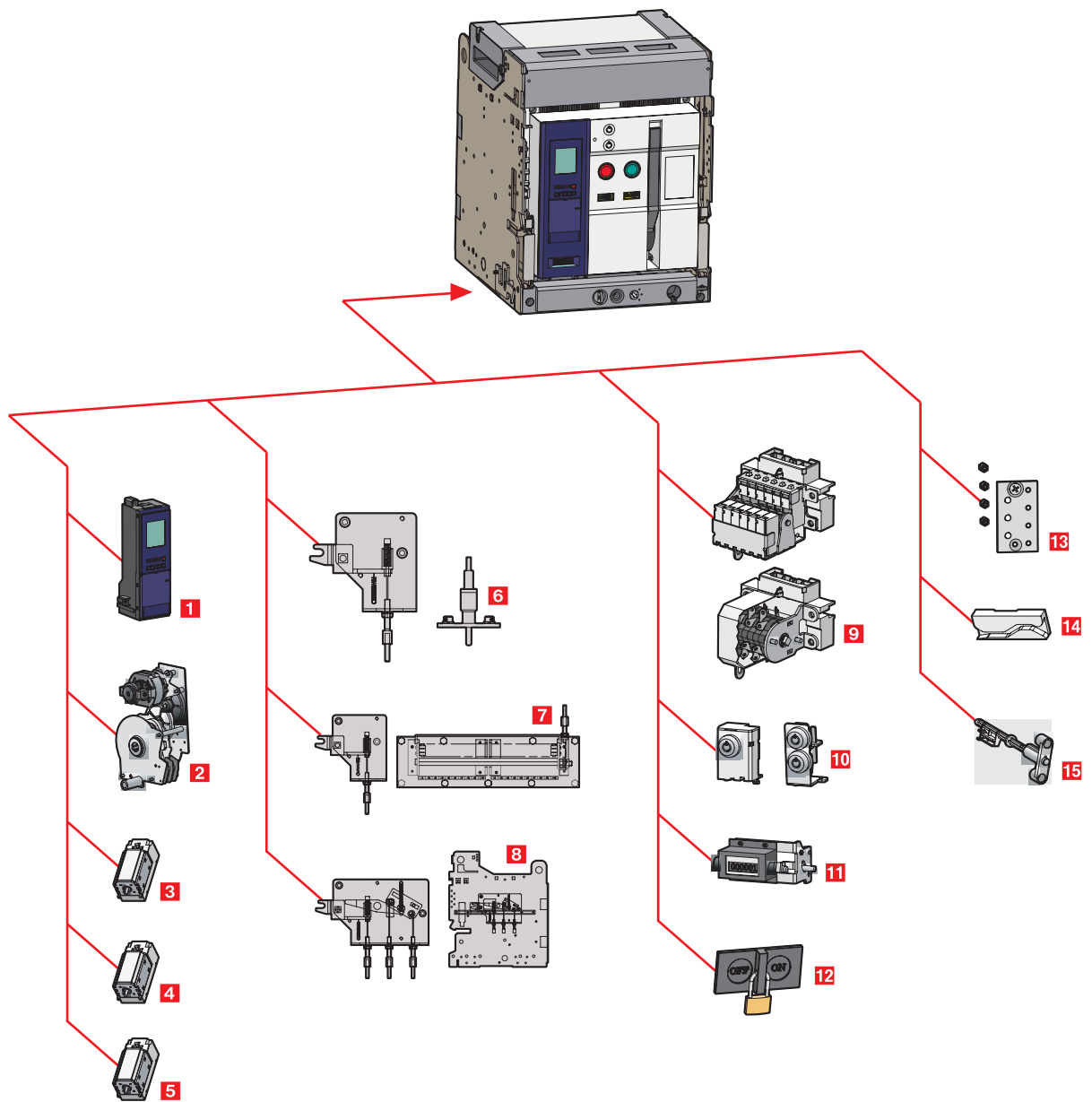


**A Type (Ammeter)**  
• Current Meter + Current protection +  
DO control + Communication



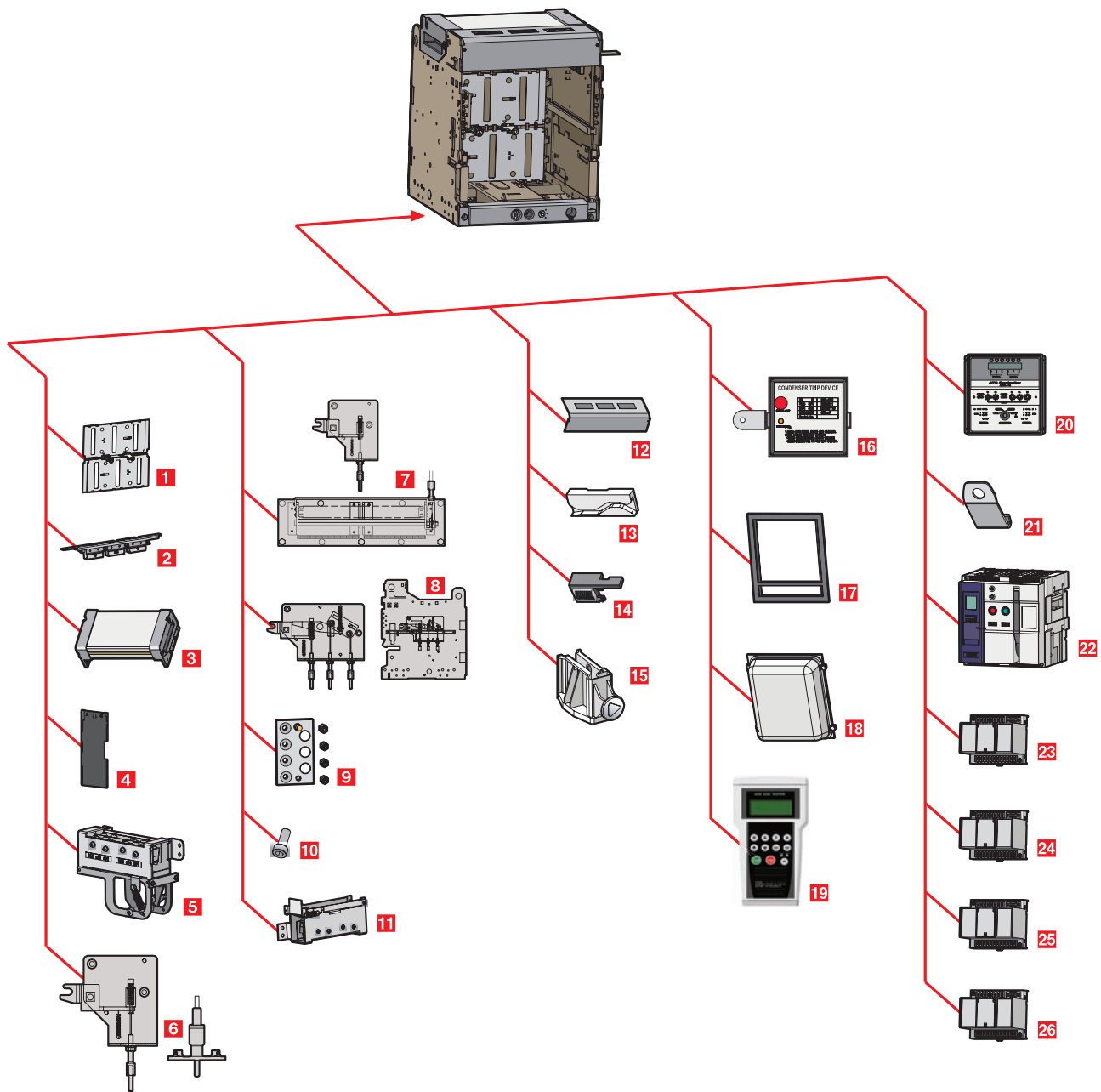
**S Type (Supreme)**  
• P type + Harmonics analysis (63 th) +  
Fault wave recording

# Accessories



## ACB

- |  |   |
|--|---|
| <b>1</b> Trip relay (OCR)                        | <b>9</b> Auxiliary Switch (AX)                    |
| <b>2</b> Motor (M)                               | <b>10</b> Key Lock (K1), Double Key Lock (K3)     |
| <b>3</b> Closing Coil (CC)                       | <b>11</b> Counter (C)                             |
| <b>4</b> Shunt Coil (SHT)                        | <b>12</b> On / Off Button Lock (B)                |
| <b>5</b> Under Voltage Trip Device (UVT)         | <b>13</b> Miss Insertion Preventing Device (MIP)  |
| <b>6</b> Door Interlock (DI)                     | <b>14</b> Automatically Discharge Mechanism (ADM) |
| <b>7</b> MOC (Mechanically Operated Cell Switch) | <b>15</b> Manual Reset Button (MRB)               |
| <b>8</b> Mechanical Interlock (MI)               |   |



## Cradle

- 1** Safety Shutter (ST)
- 2** Manual Connector
- 3** Zero Arc Space (ZAS)
- 4** Insulation Barrier (IB)
- 5** Cell Switch (CEL)
- 6** Door Interlock (DI)
- 7** MOC (Mechanically Operated Cell Switch)

- 8** Mechanical Interlock (MI)
- 9** Miss Insertion Prevent Device (MIP)
- 10** Cladle Mounting Block (CMB)
- 11** Shorting "b" Contact (SBC)
- 12** Safety Control Cover (SC)
- 13** Automatically Discharge Mechanism (ADM)
- 14** Racking Interlock (RI)
- 15** Safety Shutter Lock (STL)

## Others

- 16** Condenser Trip Device (CTD)
- 17** Door Frame (DF)
- 18** Dust Cover (DC)
- 19** OCR Tester (OT)
- 20** ATS Controller (ATS)
- 21** Lifting Hook (LH)
- 22** Dummy ACB
- 23** UVT Time Delay Controller (UDC)
- 24** Profibus-DP Communication module
- 25** Remote I/O
- 26** Temperature Alarm

# Multiple connections

## Various installation methods

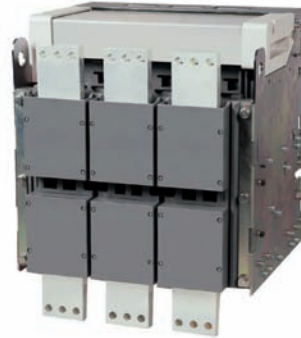
### Standard connection



Horizontal type



Vertical type



Front type

### Mixed connection



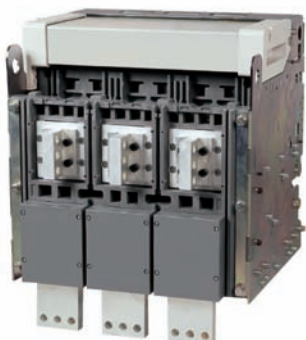
Horizontal/Vertical type



Vertical/Horizontal type



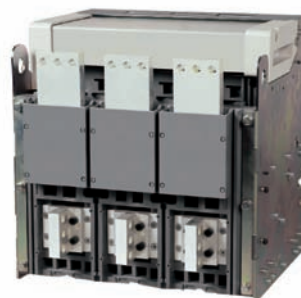
Horizontal/Front type



Vertical/Front type



Front/Horizontal type



Front/Vertical type

- Front connection type is available to be connected regardless of the depth of main circuit terminal, and it is suited for the panel required for limited installation space.
- The vertical and horizontal type terminal are module types which can easily compose the vertical and horizontal terminals by rotating 90°  
Vertical and horizontal terminals are different each other for over 3200AF ACBs

Please refer to the rating lists (Page 18 – 21) because the installation method is various according to the rated current.



# External configuration

## Fixed type ACB



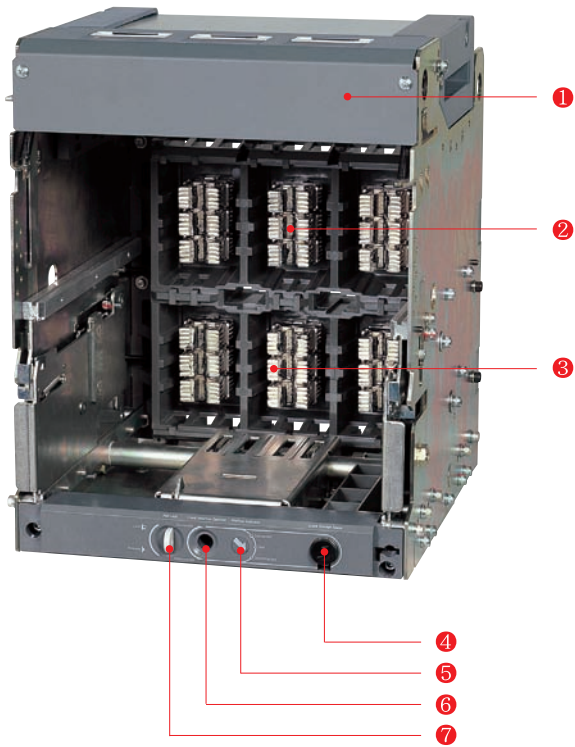
### Terms

- ① Trip relay
- ② Counter
- ③ ON button
- ④ OFF button
- ⑤ Charge handle
- ⑥ Rated name plate
- ⑦ Charge/Discharge indicator
- ⑧ ON/OFF indicator
- ⑨ Corporation logo
- ⑩ Arc cover
- ⑪ Terminal cover
- ⑫ Cradle
- ⑬ Draw-out handle
- ⑭ Position indicator
- ⑮ Handle storage space
- ⑯ Pad lock button
- ⑰ Art chute
- ⑱ Control cover
- ⑲ Fixed type bracket

## Draw-out ACB (Cradle)



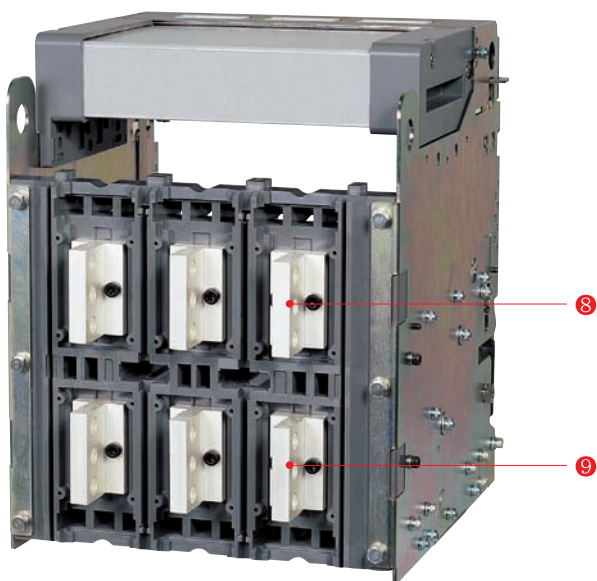
## Cradle (Internal)



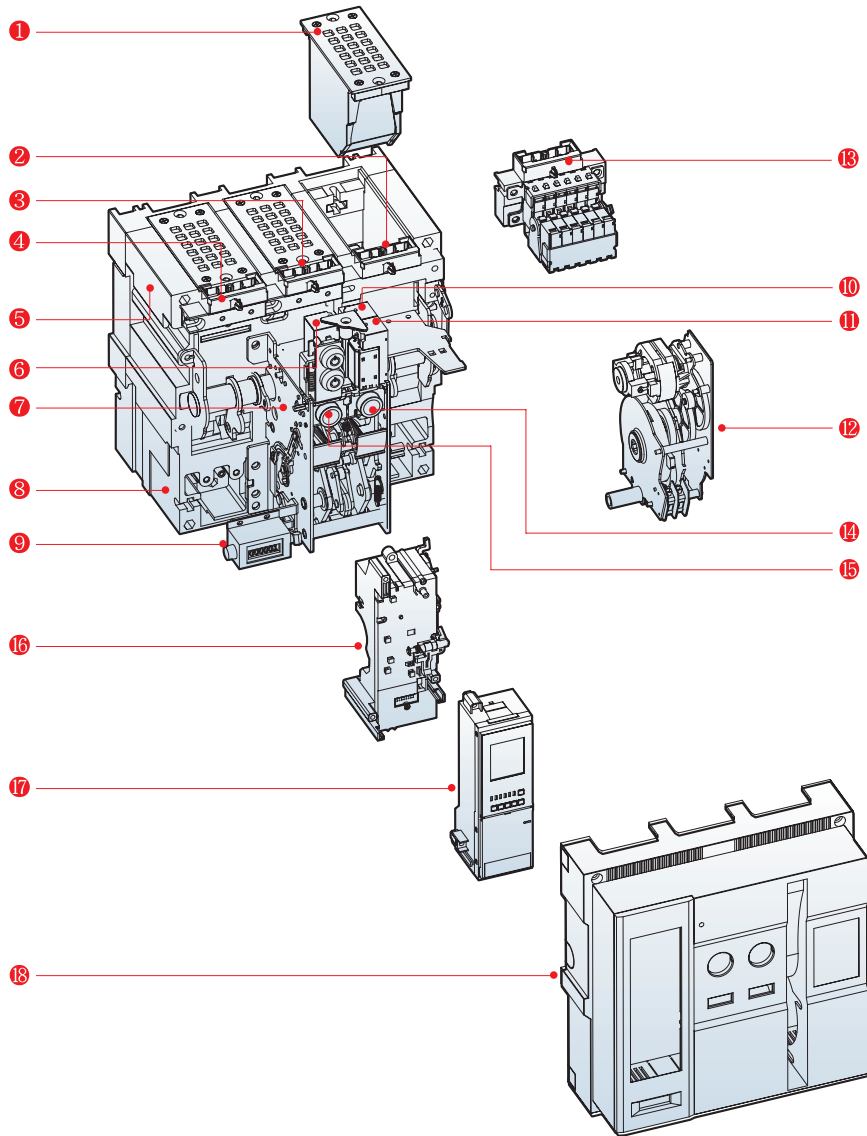
## Terms

- ① Terminal cover of control circuit
- ② Cradle finger (Line side)
- ③ Cradle finger (Load side)
- ④ Draw-out handle
- ⑤ Position indicator
- ⑥ Handle storage space
- ⑦ Pad lock button
- ⑧ Connecting conductor (Line side)
- ⑨ Connecting conductor (Load side)

## Cradle (Rear)



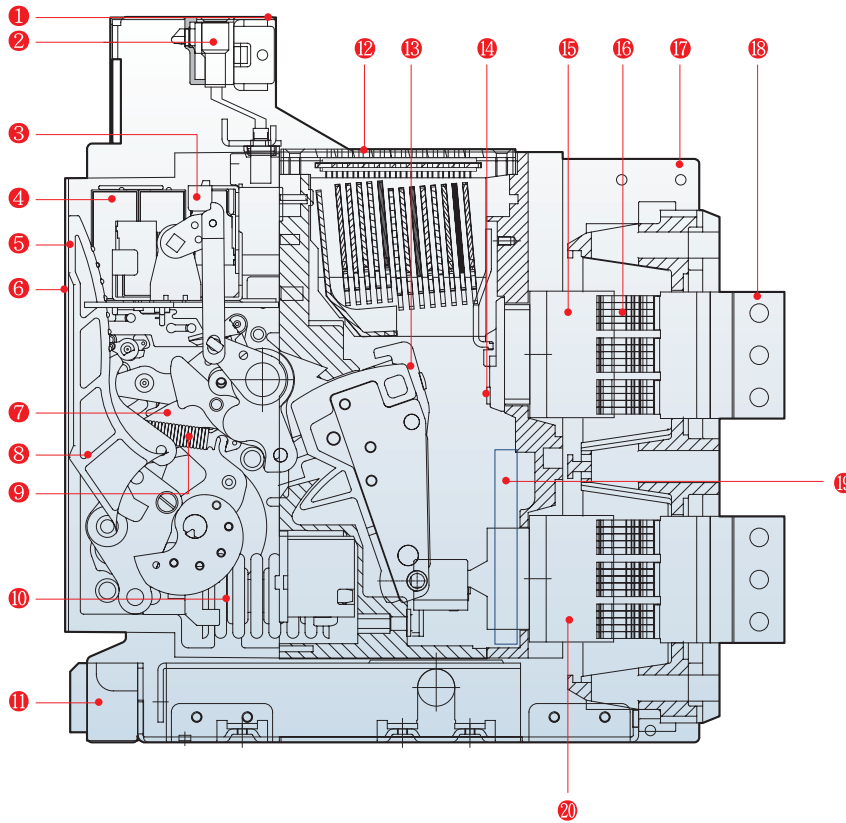
# Internal configuration



## Terms

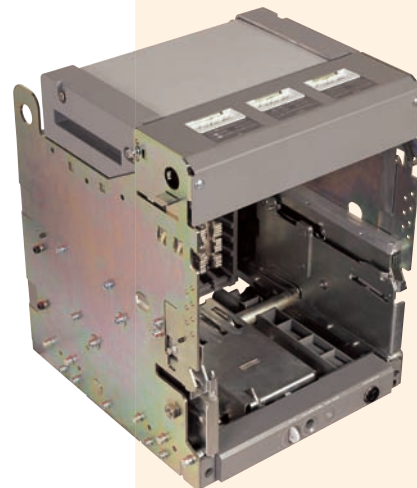
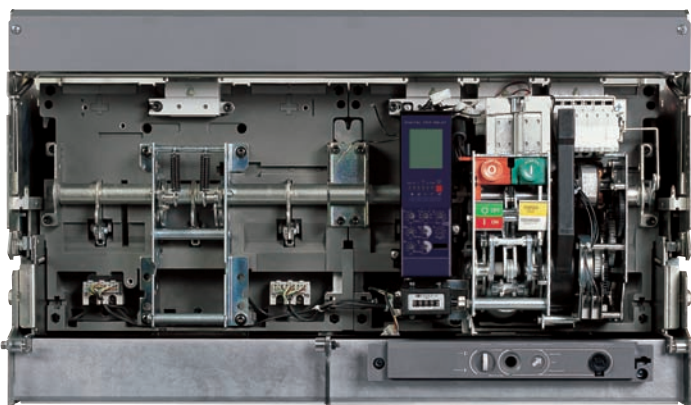
- ① Arc chute
- ② Aux. switch control terminal
- ③ Control power supply terminal
- ④ Trip relay control terminal
- ⑤ Carrying grip
- ⑥ Trip coil or UVT coil
- ⑦ Mechanism
- ⑧ Main body
- ⑨ Counter
- ⑩ Trip coil
- ⑪ Closing coil
- ⑫ Motor Ass'y
- ⑬ Aux. switch
- ⑭ ON button
- ⑮ OFF button
- ⑯ MTD base
- ⑰ Trip relay
- ⑱ Front cover





## Terms

- ① Control circuit terminal block
- ② Control terminal
- ③ Auxiliary switches
- ④ Closing, Trip, UVT coil
- ⑤ Trip relay
- ⑥ Front cover
- ⑦ Mechanism
- ⑧ Charge handle
- ⑨ Trip spring
- ⑩ Closing spring
- ⑪ Draw-in/out device
- ⑫ Arc extinguishing part
- ⑬ Moving contact
- ⑭ Fixed contact
- ⑮ Conductor on line side
- ⑯ Cradle finger
- ⑰ Cradle
- ⑱ Connecting conductor
- ⑳ Conductor on load side



# Ordering

## ACB & Accessories

| Type | Ampere frame | Frame size & phase array    | No. of pole | Rated current (CT Spec.) | Connections  |
|------|--------------|-----------------------------|-------------|--------------------------|--|
| AKH  | -            | 3P/4P Standard type RST (N) | 3 3P (D)    | 00 Without OCR & CT      | Draw-out type                                      |
| AKS  | 06 630AF     | D                           | 3 3P (D)    | 02 200A                  | J Manual connection                                |
| AKN  | 08 830AF     |                             |             | 04 400A                  |  |
| AKH  | 10 1000AF    | W                           | 4 4P (D, W) | 06 630A                  | A Automatic connection                             |
|      | 13 1250AF    |                             |             | 08 800A                  |  |
|      | 16 1600AF    |                             |             | 10 1000A                 |  |
|      | 20 2000AF    |                             |             | 13 1250A                 |  |
| AKS  | 25 2500AF    | W                           | 4 4P (D, W) | 16 1600A                 | M Mixed type<br>Line: Horizontal<br>Load: Vertical |
| AKS  | 32 3200AF    |                             |             | 20 2000A                 |  |
|      | 40 4000AF    |                             |             | 25 2500A                 |  |
|      | 50 5000AF    |                             |             | 32 3200A                 |  |
| AKS  | 63 6300AF    | Y                           | 4 4P (F, Y) | 40 4000A                 | N Mixed type<br>Line: Vertical<br>Load: Horizontal |
|      | 50 5000AF    |                             |             | 40 4000A                 |  |
| AKS  | 50 5000AF    | F                           | 3 3P (F)    | 50 5000A                 | P Front type                                       |
|      | 63 6300AF    |                             |             | 50 5000A                 |  |
| AKH  | 40 4000AF    | G                           | 3 3P (G)    | 40 4000A                 | M Mixed type<br>Line: Horizontal<br>Load: Vertical |
|      | 50 5000AF    |                             |             | 40 4000A                 |  |
| AKS  | 50 5000AF    | Z                           | 4 4P (G, Z) | 50 5000A                 | N Mixed type<br>Line: Vertical<br>Load: Horizontal |
|      | 63 6300AF    |                             |             | 50 5000A                 |  |

| Motor rated voltage | Shunt coil rated voltage | Trip relay       |
|---------------------|--------------------------|------------------|
| MA Without Motor    | D0 Without Shunt coil    | Refer to 22 page |
| M1 AC/DC 100 – 130V | D1 AC/DC 100 – 130V      |                  |
| M2 AC/DC 200 – 250V | D2 AC/DC 200 – 250V      |                  |
| M3 DC 125V          | D3 DC 125V               |                  |
| M4 DC 24 – 30V      | D4 DC 24 – 30V           |                  |
| M5 DC 48 – 60V      | D5 DC 48 – 60V           |                  |
| M6 AC 380 – 415V    | D6 AC 380 – 480V         |                  |
| M7 AC 440 – 480V    | D7 AC 48V                |                  |
| M8 AC 48V           |                          |                  |

| Closing coil rated voltage | Closing coil rated voltage       | UVT coil rated voltage |
|----------------------------|----------------------------------|------------------------|
| D0 Without Closing coil    | AX Standard OFF-Charge 3a3b      | U0 Without UVT coil    |
| D1 AC/DC 100 – 130V        | AC Standard ON-Charge 3a3b       | U1 AC/DC 100 – 130V    |
| D2 AC/DC 200 – 250V        | BX Standard OFF-Charge 5a5b      | U2 AC/DC 200 – 250V    |
| D3 DC 125V                 | BC Standard ON-Charge 5a5b       | U3 DC 125V             |
| D4 DC 24 – 30V             | HX High capacity OFF-Charge 5a5b | U4 DC 24 – 30V         |
| D5 DC 48 – 60V             | HC High capacity ON-Charge 5a5b  | U5 DC 48 – 60V         |
| D6 AC 380 – 480V           | CC Standard ON-Charge 6a6b       | U6 AC 380 – 480V       |
| D7 AC 48V                  | JC High capacity ON-Charge 6a6b  | U7 AC 48V              |

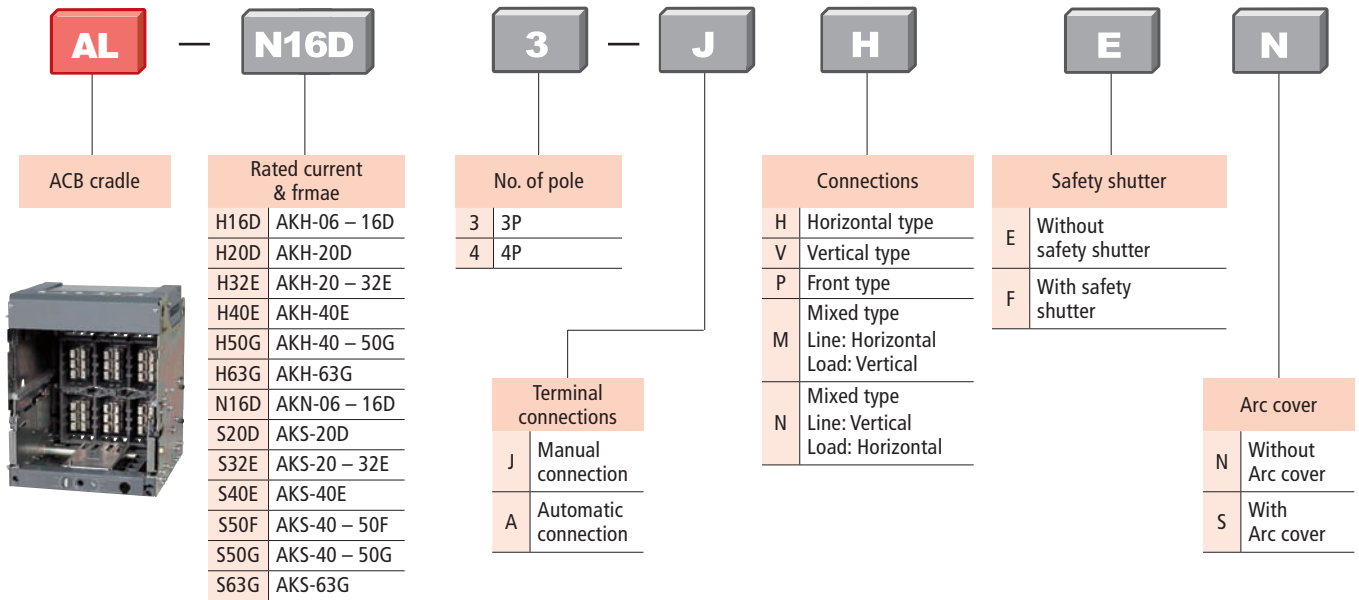
  

| Accessories |   |   |
|-------------|---|---|
| AL          | AL1 + MRB                                       | Trip alarm contact 1a + Manual reset button                       |
| A2          | AL1 + AL2 + MRB                                 | Trip alarm contact 2a + Manual reset button                       |
| A3          | AL1 + MRB + RES (AC/DC 100 – 130V)              | Trip alarm contact 1a + Manual reset button + Remote reset switch |
| A4          | AL1 + MRB + RES (AC/DC 200 – 250V)              | Trip alarm contact 1a + Manual reset button + Remote reset switch |
| A5          | AL1 + MRB + Auto reset                          | AL + Auto reset type  |
| A6          | AL1 + AL2 + MRB + Auto reset                    | A2+ Auto reset type   |
| A7          | AL1 + MRB + RES (AC/DC 100 – 130V) + Auto reset | A3 + Auto reset type  |
| A8          | AL1 + MRB + RES (AC/DC 200 – 250V) + Auto reset | A4 + Auto reset type  |
| C           | C   | Counter   |
| S           | CS2   | Charge switch communication                                       |
| B           | B   | ON/OFF button lock  |
| M           | MI  | Mechanical Interlock  |
| D           | DI or MOC                                       | Door Interlock or Mechanical Operated Cell Switch                 |
| K           | K1  | Key Lock  |
| K2          | K2  | Key Interlock set   |
| K3          | K3  | Key Lock double   |
| R           | RCS   | Ready to close switch   |
| T           | TM  | Temperature Alarm   |
| H 1)        | SHT2  | Double Shut Coil  |

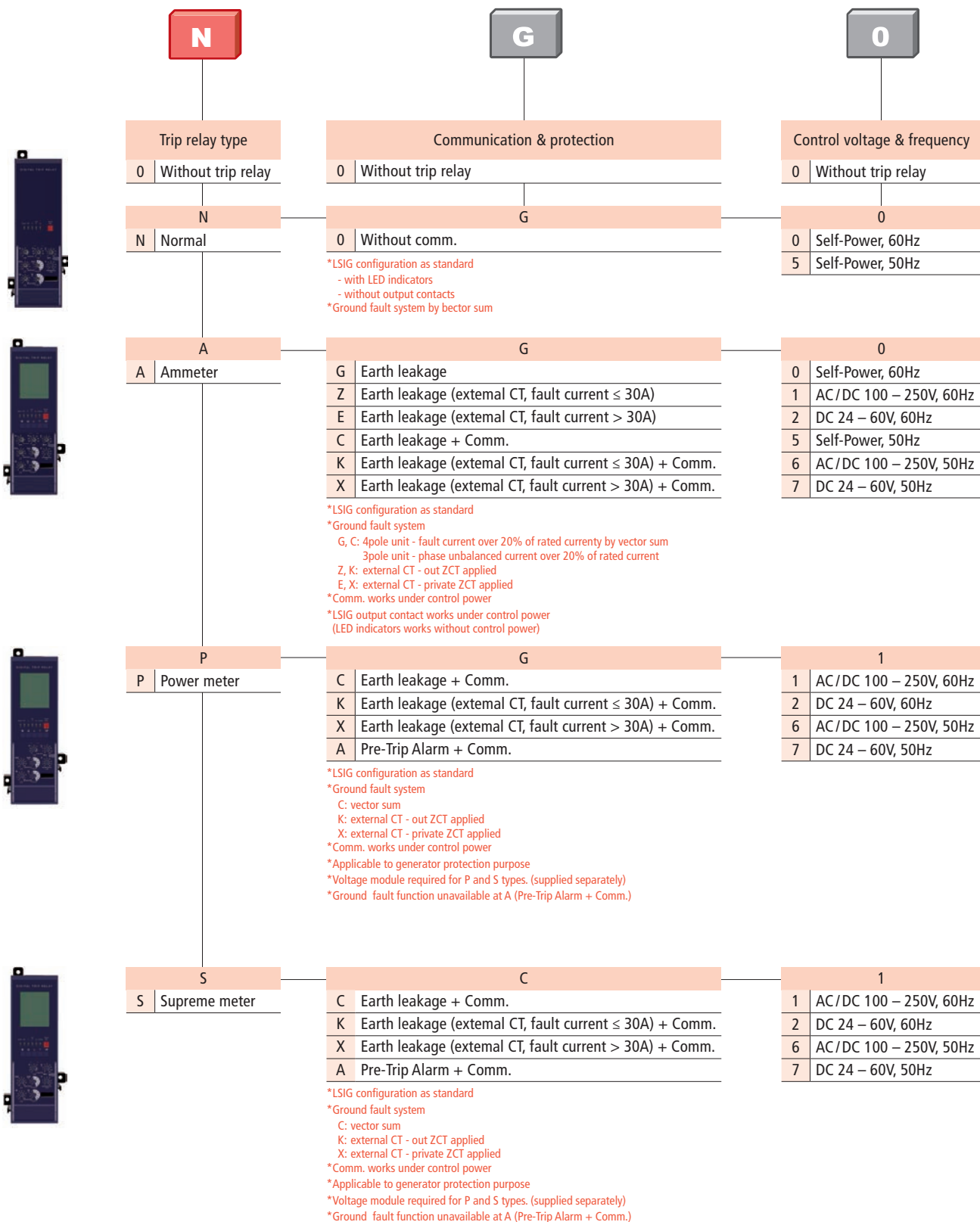
Note) 1. UVT and SHT2 are alternative.  
2. Other accessories should be ordered separately. (Refer to 48 page)

# Ordering

## Cradle



# Trip relay



Note) The function like Metering, Communication, ZSI, Remote Reset and DO control are not available only under Self-Power condition.

# Rating



| Type   |                                   |                             | AKH-06D              | AKH-08D         | AKH-10D | AKH-13D | AKH-16D | AKH-20D |
|--|-----------------------------------|-----------------------------|----------------------|-----------------|---------|---------|---------|---------|
| Ampere frame                                   | (AF)                              |                             | 630                  | 800             | 1000    | 1250    | 1600    | 2000    |
| Rated current (A)                              | (in max)                          | at 40°C                     | 200                  | 400             |         |         |         |         |
|  |                                   |                             | 400                  | 630             | 1000    | 1250    | 1600    | 2000    |
|  |                                   |                             | 630                  | 800             |         |         |         |         |
| Setting current (A)*                           | Control trip relay (... x in max) |                             | (0.4 – 1.0) x in max |                 |         |         |         |         |
| Rated current of neutral pole (A)              |                                   |                             | 400                  | 400             | 1000    | 1250    | 1600    | 2000    |
|  |                                   |                             | 630                  | 800             |         |         |         |         |
| Rated insulation voltage (V)                   | (Ui)                              |                             | 1,000                |                 |         |         |         |         |
| Rated operating voltage (V)                    | (Ue)                              |                             | 690                  |                 |         |         |         |         |
| Rated impulse withstand voltage (kV)           | (Uimp)                            |                             | 12                   |                 |         |         |         |         |
| Frequency (Hz)                                 |                                   |                             | 50/60                |                 |         |         |         |         |
| Number of poles (P)                            |                                   |                             | 3, 4                 |                 |         |         |         |         |
| Rated breaking capacity (kA sym)<br>AC 50/60Hz | (Icu)                             | IEC 60947-2                 | 220V/230V/380V/415V  |                 |         | 85      |         |         |
|  |                                   | JISC 8201-2-1               | 460V/480V/500V       |                 |         | 85      |         |         |
|  |                                   |                             | 550V/600V/690V       |                 |         | 65      |         |         |
| Rated service breaking capacity (kA)           | (Ics)                             |                             | ...% x Icu           |                 |         | 100%    |         |         |
| Rated making capacity (kA peak)<br>AC 50/60Hz  | (Icm)                             | IEC 60947-2                 | 220V/230V/380V/415V  |                 |         | 187     |         |         |
|  |                                   | JISC 8201-2-1               | 460V/480V/500V       |                 |         | 187     |         |         |
|  |                                   |                             | 550V/600V/690V       |                 |         | 143     |         |         |
| Rated short-time<br>withstand current (kA)     | (Icw)                             |                             | 1 sec                |                 |         | 65      |         |         |
|  |                                   |                             | 2 sec                |                 |         | 60      |         |         |
|  |                                   |                             | 3 sec                |                 |         | 50      |         |         |
| Operating time (ms)                            |                                   | Maximum total breaking time | 40                   |                 |         |         |         |         |
|  |                                   | Maximum closing time        | 80                   |                 |         |         |         |         |
| Life cycle (time)                              | Mechanical                        | Without maintenance         | 20,000               |                 |         |         |         |         |
|  |                                   | With maintenance            | 30,000               |                 |         |         |         |         |
|  | Electrical                        | Without maintenance         | 5,000                |                 |         |         |         |         |
|  |                                   | With maintenance            | 10,000               |                 |         |         |         |         |
| Connections**                                  | Draw-out<br>/ Fixed               | Horizontal connection       | ●                    |                 |         |         |         | -       |
|  |                                   | Vertical connection         | ○                    |                 |         |         |         | ●       |
|  |                                   | Front connection            | ○                    |                 |         |         |         | -       |
|  |                                   | Mixed connection            | ○                    |                 |         |         |         | -       |
| Weight (kg)<br>(3P/4P)                         | Draw-out type                     | Main body                   | Motor charging type  |                 |         | 63/74   |         | 70/85   |
|  |                                   | (With cradle)               | Manual charging type |                 |         | 61/72   |         | 68/83   |
|  |                                   | Cradle only                 |                      |                 |         | 29/32   |         | 33/40   |
|  | Fixed type                        | Motor charging type         |                      |                 | 34/44   |         | 38/47   |         |
|  |                                   | Manual charging type        |                      |                 | 32/42   |         | 36/45   |         |
|  |                                   |                             |                      |                 |         |         |         |         |
| External dimensions (mm)<br>(H x W x D)        |                                   | Draw-out type               | 3P                   | 430 x 334 x 375 |         |         |         |         |
|  |                                   |                             | 4P                   | 430 x 419 x 375 |         |         |         |         |
|  |                                   | Fixed type                  | 3P                   | 300 x 300 x 295 |         |         |         |         |
|  |                                   |                             | 4P                   | 300 x 385 x 295 |         |         |         |         |
| Trip relay                                     |                                   |                             | N, A, P, S type      |                 |         |         |         |         |
| Certificate & Approval                         |                                   |                             | KEMA                 |                 |         |         |         |         |

\*Refer to trip relay specification. \*\*●: Standard, ○: Option





| AKH-06E              | AKH-08E | AKH-10E | AKH-13E | AKH-16E | AKH-20E | AKH-25E | AKH-32E | AKH-40E |
|----------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| 630                  | 800     | 1000    | 1250    | 1600    | 2000    | 2500    | 3200    | 4000    |
| 630                  | 800     | 1000    | 1250    | 1600    | 2000    | 2500    | 3200    | 4000    |
| (0.4 – 1.0) x In max |         |         |         |         |         |         |         |         |
| 630                  | 800     | 1000    | 1250    | 1600    | 2000    | 2500    | 3200    | 4000    |
| 1,000                |         |         |         |         |         |         |         |         |
| 690                  |         |         |         |         |         |         |         |         |
| 12                   |         |         |         |         |         |         |         |         |
| 50/60                |         |         |         |         |         |         |         |         |
| 3, 4                 |         |         |         |         |         |         |         |         |
| 100                  |         |         |         |         |         |         |         |         |
| 100                  |         |         |         |         |         |         |         |         |
| 85                   |         |         |         |         |         |         |         |         |
| 100%                 |         |         |         |         |         |         |         |         |
| 220                  |         |         |         |         |         |         |         |         |
| 220                  |         |         |         |         |         |         |         |         |
| 187                  |         |         |         |         |         |         |         |         |
| 85                   |         |         |         |         |         |         |         |         |
| 75                   |         |         |         |         |         |         |         |         |
| 65                   |         |         |         |         |         |         |         |         |
| 40                   |         |         |         |         |         |         |         |         |
| 80                   |         |         |         |         |         |         |         |         |
| 15,000               |         |         |         |         |         |         |         |         |
| 20,000               |         |         |         |         |         |         |         |         |
| 5,000                |         |         |         |         |         |         |         |         |
| 10,000               |         |         |         |         |         |         |         |         |
| ●                    |         |         |         |         |         |         |         | ○       |
| ○                    |         |         |         |         |         |         |         | ●       |
| ○                    |         |         |         |         |         |         |         | -       |
| ○                    |         |         |         |         |         |         |         | -       |
| 87/103               |         |         |         |         |         |         |         | 104/147 |
| 85/101               |         |         |         |         |         |         |         | 102/145 |
| 44/55                |         |         |         |         |         |         |         | 58/70   |
| 44/55                |         |         |         |         |         |         |         | 63/100  |
| 42/53                |         |         |         |         |         |         |         | 61/98   |
| 430 x 412 x 375      |         |         |         |         |         |         |         |         |
| 430 x 527 x 375      |         |         |         |         |         |         |         |         |
| 300 x 378 x 295      |         |         |         |         |         |         |         |         |
| 300 x 493 x 295      |         |         |         |         |         |         |         |         |
| N, A, P, S type      |         |         |         |         |         |         |         |         |
| KEMA                 |         |         |         |         |         |         |         |         |

| AKH-40G              | AKH-50G | AKH-63G |
|----------------------|---------|---------|
| 4000                 | 5000    | 6300    |
| 4000                 | 5000    | 6300    |
| (0.4 – 1.0) x In max |         |         |
| 4000                 | 5000    | 6300    |
| 1,000                |         |         |
| 690                  |         |         |
| 12                   |         |         |
| 50/60                |         |         |
| 3, 4                 |         |         |
| 150                  |         |         |
| 150                  |         |         |
| 100                  |         |         |
| 100%                 |         |         |
| 330                  |         |         |
| 330                  |         |         |
| 220                  |         |         |
| 100                  |         |         |
| 100                  |         |         |
| 100                  |         |         |
| 40                   |         |         |
| 80                   |         |         |
| 10,000               |         |         |
| 15,000               |         |         |
| 2,000                |         |         |
| 5,000                |         |         |
| ○                    |         | ○       |
| ●                    |         | ●       |
| -                    |         | -       |
| -                    |         | -       |
| 181/223              |         | 186/230 |
| 179/221              |         | 184/228 |
| 97/117               |         | 102/124 |
| 98/123               |         | 103/130 |
| 96/121               |         | 101/128 |
| 460 x 785 x 375      |         |         |
| 460 x 1,015 x 375    |         |         |
| 300 x 751 x 295      |         |         |
| 300 x 981 x 295      |         |         |
| N, A, P, S type      |         |         |
| KEMA                 |         |         |

# Rating



| Type   |                                   |                            | AKN-06D                     | AKN-08D         | AKN-10D | AKN-13D | AKN-16D | AKS-20D |      |
|--|-----------------------------------|----------------------------|-----------------------------|-----------------|---------|---------|---------|---------|------|
| Ampere frame                                   | (AF)                              |                            | 630                         | 800             | 1000    | 1250    | 1600    | 2000    |      |
| Rated current (A)                              | (in max)                          | at 40°C                    | 200                         | 400             |         |         |         |         |      |
|  |                                   |                            | 400                         | 630             | 1000    | 1250    | 1600    | 2000    |      |
|  |                                   |                            | 630                         | 800             |         |         |         |         |      |
| Setting current (A)*                           | Control trip relay (... x in max) |                            | (0.4 – 1.0) x in max        |                 |         |         |         |         |      |
| Rated current of neutral pole (A)              |                                   |                            | 400                         | 400             | 1000    | 1250    | 1600    | 2000    |      |
|  |                                   |                            | 630                         | 800             |         |         |         |         |      |
| Rated insulation voltage (V)                   | (Ui)                              |                            | 1,000                       |                 |         |         |         |         |      |
| Rated operating voltage (V)                    | (Ue)                              |                            | 690                         |                 |         |         |         |         |      |
| Rated impulse withstand voltage (kV)           | (Uimp)                            |                            | 12                          |                 |         |         |         |         |      |
| Frequency (Hz)                                 |                                   |                            | 50/60                       |                 |         |         |         |         |      |
| Number of poles (P)                            |                                   |                            | 3, 4                        |                 |         |         |         |         |      |
| Rated breaking capacity (kA sym)<br>AC 50/60Hz | (Icu)                             | IEC 60947-2                | 220V/230V/380V/415V         |                 |         | 65      |         |         | 70   |
|  |                                   | JISC 8201-2-1              | 460V/480V/500V              |                 |         | 65      |         |         | 70   |
|  |                                   |                            | 550V/600V/690V              |                 |         | 50      |         |         | 65   |
| Rated service breaking capacity (kA)           | (Ics)                             |                            | ...% x Icu                  |                 |         | 100%    |         |         | 100% |
| Rated making capacity (kA peak)<br>AC 50/60Hz  | (Icm)                             | IEC 60947-2                | 220V/230V/380V/415V         |                 |         | 143     |         |         | 154  |
|  |                                   | JISC 8201-2-1              | 460V/480V/500V              |                 |         | 143     |         |         | 154  |
|  |                                   |                            | 550V/600V/690V              |                 |         | 105     |         |         | 143  |
| Rated short-time<br>withstand current (kA)     | (Icw)                             |                            | 1 sec                       |                 |         | 50      |         |         | 65   |
|  |                                   |                            | 2 sec                       |                 |         | 42      |         |         | 55   |
|  |                                   |                            | 3 sec                       |                 |         | 36      |         |         | 50   |
| Operating time (ms)                            |                                   |                            | Maximum total breaking time |                 |         | 40      |         |         |      |
|  |                                   |                            | Maximum closing time        |                 |         | 80      |         |         |      |
| Life cycle (time)                              | Mechanical                        |                            | Without maintenance         |                 |         | 20,000  |         |         |      |
|  |                                   |                            | With maintenance            |                 |         | 30,000  |         |         |      |
|  | Electrical                        |                            | Without maintenance         |                 |         | 5,000   |         |         |      |
|  |                                   |                            | With maintenance            |                 |         | 10,000  |         |         |      |
| Connections**                                  | Draw-out<br>/ Fixed               |                            | Horizontal connection       |                 |         | ●       |         |         | -    |
|  |                                   |                            | Vertical connection         |                 |         | ○       |         |         | ●    |
|  |                                   |                            | Front connection            |                 |         | ○       |         |         | -    |
|  |                                   |                            | Mixed connection            |                 |         | ○       |         |         | -    |
| Weight (kg)<br>(3P/4P)                         | Draw-out type                     | Main body<br>(With cradle) | Motor charging type         |                 | 63/74   |         |         | 70/85   |      |
|  |                                   |                            | Manual charging type        |                 | 61/72   |         |         | 68/83   |      |
|  |                                   | Cradle only                |                             | 29/32           |         |         | 33/40   |         |      |
|  | Fixed type                        | Motor charging type        |                             | 34/44           |         |         | 38/47   |         |      |
|  |                                   | Manual charging type       |                             | 32/42           |         |         | 36/45   |         |      |
|  |                                   |                            |                             |                 |         |         |         |         |      |
| External dimensions (mm)<br>(H x W x D)        |                                   | Draw-out<br>type           | 3P                          | 430 x 334 x 375 |         |         |         |         |      |
|  |                                   |                            | 4P                          | 430 x 419 x 375 |         |         |         |         |      |
|  |                                   | Fixed type                 | 3P                          | 300 x 300 x 295 |         |         |         |         |      |
|  |                                   |                            | 4P                          | 300 x 385 x 295 |         |         |         |         |      |
| Trip relay                                     |                                   |                            | N, A, P type                |                 |         |         |         |         |      |
| Certificate & Approval                         |                                   |                            | KEMA                        |                 |         |         |         |         |      |

\*Refer to trip relay specification. \*\*●: Standard, ○: Option



| AKS-20E              | AKS-25E | AKS-32E | AKS-40E |
|----------------------|---------|---------|---------|
| 2000                 | 2500    | 3200    | 4000    |
| 630, 800             |         |         |         |
| 1000, 1250           | 2500    | 3200    | 4000    |
| 1600, 2000           |         |         |         |
| (0.4 – 1.0) x In max |         |         |         |
| 630, 800             |         |         |         |
| 1000, 1250           | 2500    | 3200    | 4000    |
| 1600, 2000           |         |         |         |
| 1,000                |         |         |         |
| 690                  |         |         |         |
| 12                   |         |         |         |
| 50/60                |         |         |         |
| 3, 4                 |         |         |         |
| 85                   |         |         |         |
| 85                   |         |         |         |
| 85                   |         |         |         |
| 100%                 |         |         |         |
| 187                  |         |         |         |
| 187                  |         |         |         |
| 187                  |         |         |         |
| 85                   |         |         |         |
| 75                   |         |         |         |
| 65                   |         |         |         |
| 40                   |         |         |         |
| 80                   |         |         |         |
| 15,000               |         |         |         |
| 20,000               |         |         |         |
| 5,000                |         |         |         |
| 10,000               |         |         |         |
| ●                    |         | ○       |         |
| ○                    |         | ●       |         |
| ○                    |         | -       |         |
| ○                    |         | -       |         |
| 87/103               |         | 104/147 |         |
| 85/101               |         | 102/145 |         |
| 44/50                |         | 58/70   |         |
| 44/55                |         | 63/100  |         |
| 42/53                |         | 61/98   |         |
| 430 x 412 x 375      |         |         |         |
| 430 x 527 x 375      |         |         |         |
| 300 x 378 x 295      |         |         |         |
| 300 x 493 x 295      |         |         |         |
| N, A, P type         |         |         |         |
| KEMA                 |         |         |         |

| AKS-40F              | AKS-50F |
|----------------------|---------|
| 4000                 | 5000    |
| 4000                 | 5000    |
| (0.4 – 1.0) x In max |         |
| 4000                 | 5000    |
| 1,000                |         |
| 690                  |         |
| 12                   |         |
| 50/60                |         |
| 3, 4                 |         |
| 100                  |         |
| 100                  |         |
| 85                   |         |
| 100%                 |         |
| 220                  |         |
| 220                  |         |
| 187                  |         |
| 85                   |         |
| 75                   |         |
| 65                   |         |
| 40                   |         |
| 80                   |         |
| 10,000               |         |
| 15,000               |         |
| 2,000                |         |
| 5,000                |         |
| ○                    |         |
| ●                    |         |
| -                    |         |
| -                    |         |
| 145/173              |         |
| 143/171              |         |
| 78/90                |         |
| 76/94                |         |
| 74/92                |         |
| 460 x 629 x 375      |         |
| 460 x 799 x 375      |         |
| 300 x 597 x 295      |         |
| 300 x 767 x 295      |         |
| N, A, P type         |         |
| KEMA                 |         |

| AKS-40G              | AKS-50G | AKS-63G |
|----------------------|---------|---------|
| 4000                 | 5000    | 6300    |
| 4000                 | 5000    | 6300    |
| (0.4 – 1.0) x In max |         |         |
| 4000                 | 5000    | 6300    |
| 1,000                |         |         |
| 690                  |         |         |
| 12                   |         |         |
| 50/60                |         |         |
| 3, 4                 |         |         |
| 120                  |         |         |
| 120                  |         |         |
| 100                  |         |         |
| 100%                 |         |         |
| 264                  |         |         |
| 264                  |         |         |
| 220                  |         |         |
| 100                  |         |         |
| 90                   |         |         |
| 85                   |         |         |
| 40                   |         |         |
| 80                   |         |         |
| 10,000               |         |         |
| 15,000               |         |         |
| 2,000                |         |         |
| 5,000                |         |         |
| ○                    |         |         |
| ●                    |         |         |
| -                    |         |         |
| -                    |         |         |
| 181/223              |         | 186/230 |
| 179/221              |         | 184/228 |
| 97/117               |         | 102/124 |
| 98/123               |         | 103/130 |
| 96/121               |         | 101/128 |
| 460 x 785 x 375      |         |         |
| 460 x 1,015 x 375    |         |         |
| 300 x 751 x 295      |         |         |
| 300 x 981 x 295      |         |         |
| N, A, P type         |         |         |
| KEMA                 |         |         |

# Trip relay (OCR)

The trip relay of ACB provides the additional protection functions for voltage, frequency, unbalance, and others in addition to main protection functions for over current, short-circuit, ground fault. It supports the advanced measurement functions for voltage, current, power, electric energy, harmonics, communication function, and others.

Analog trip function interlocked with mechanism enhanced a durability of devices as well as the breaking capacity of ACB.

Zone selective interlocking function makes the protective coordination more simple and thermal memory can be applied to various loads.







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# Trip relays

## Trip relay types

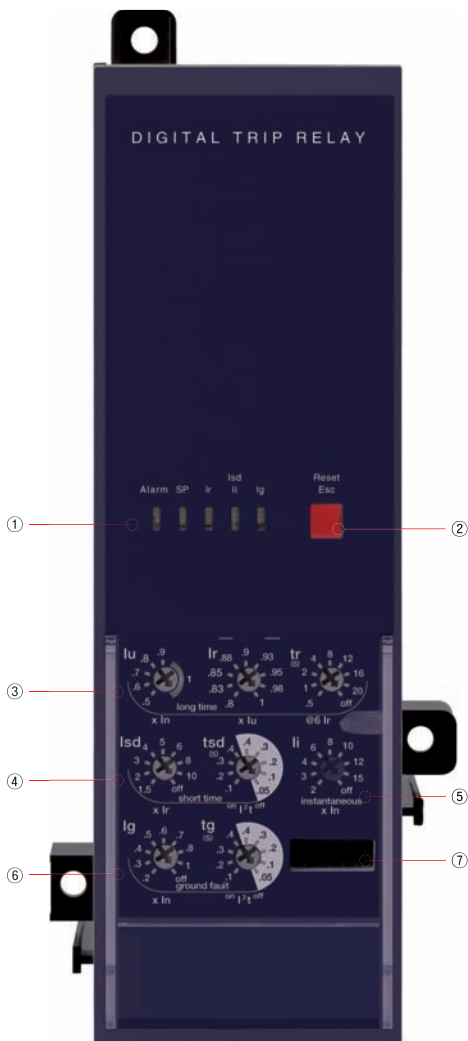
| Classification       | N type  | A type  | P type   | S type  |
|----------------------|---|---|--|---|
| Externals            |    |    |    |    |
| Current protection   | L/S/I/G/Thermal   | <ul style="list-style-type: none"> <li>L/S/I/G/Thermal</li> <li>ZSI (Protective coordination)</li> </ul>  | <ul style="list-style-type: none"> <li>L/S/I/G/Thermal (Continuous)</li> <li>ZSI (Protective coordination)</li> </ul>  | <ul style="list-style-type: none"> <li>P type</li> </ul>  |
| Other protection     | -   | <ul style="list-style-type: none"> <li>Earth leakage (Option)</li> </ul>  | <ul style="list-style-type: none"> <li>Earth leakage (Option)</li> <li>Over/Under current</li> <li>Over/Under frequency</li> <li>Unbalance (Voltage/Current)</li> <li>Reverse power</li> </ul> | <ul style="list-style-type: none"> <li>P type</li> </ul>  |
| Measurement function | -   | <ul style="list-style-type: none"> <li>Current (R/S/T/N)</li> </ul>   | <ul style="list-style-type: none"> <li>3 Phase Voltage/Current RMS/Vector</li> <li>Power (P, Q, S), PF (3-Phase)</li> <li>Energy (Positive/Negative)</li> <li>Frequency, Demand</li> </ul>     | <ul style="list-style-type: none"> <li>3 Phase Voltage/Current RMS/Vector</li> <li>Power (P, Q, S), PF (3-Phase)</li> <li>Energy (Positive/Negative)</li> <li>Frequency, Demand</li> <li>Voltage/Current harmonics (1st – 63th)</li> <li>3 Phase Waveforms</li> <li>THD, TDD, K-Factor</li> </ul> |
| Fine adjustment      | -   | -   | <ul style="list-style-type: none"> <li>Fine adjustment for long/short time delay/instantaneous/ground</li> </ul>   | <ul style="list-style-type: none"> <li>P type</li> </ul>  |
| Pre Trip Alarm       | -   | -   | <ul style="list-style-type: none"> <li>Overload protection relays: DO (Alarm) (Ground fault is not available when using Pre trip alarm)</li> </ul>   | <ul style="list-style-type: none"> <li>P type</li> </ul>  |
| Digital Output       | -   | <ul style="list-style-type: none"> <li>3DO (Fixed)</li> <li>L, S/I, G Alarm</li> </ul>  | <ul style="list-style-type: none"> <li>3DO (Programmable)</li> <li>Trip, Alarm, General</li> </ul>   | <ul style="list-style-type: none"> <li>P type</li> </ul>  |
| IDMTL setting        | -   | -   | <ul style="list-style-type: none"> <li>Compliance with IEC60255-3</li> <li>SIT, VIT, EIT, DT</li> </ul>  | <ul style="list-style-type: none"> <li>P type</li> </ul>  |
| Communication        | -   | <ul style="list-style-type: none"> <li>Modbus/RS – 485</li> <li>Profibus – DP</li> </ul>  | <ul style="list-style-type: none"> <li>Modbus/RS – 485</li> <li>Profibus – DP</li> </ul>   | <ul style="list-style-type: none"> <li>Modbus/RS – 485</li> <li>Profibus – DP</li> </ul>  |
| Power supply         | <ul style="list-style-type: none"> <li>Self Power</li> <li>Power source works over 20% of load current.</li> </ul>              | <ul style="list-style-type: none"> <li>Self Power</li> <li>Power source works over 20% of load current.</li> <li>External power source are required for comm.</li> <li>AC/DC 100 – 250V</li> <li>DC 24 – 60V</li> </ul> | <ul style="list-style-type: none"> <li>AC/DC 100 – 250V</li> <li>DC 24 – 60V</li> </ul>  | <ul style="list-style-type: none"> <li>AC/DC 100 – 250V</li> <li>DC 24 – 60V</li> </ul>   |
| RTC timer            | <ul style="list-style-type: none"> <li>Available</li> </ul>   | <ul style="list-style-type: none"> <li>Available</li> </ul>   | <ul style="list-style-type: none"> <li>Available</li> </ul>  | <ul style="list-style-type: none"> <li>Available</li> </ul>   |
| LED for trip info.   | <ul style="list-style-type: none"> <li>Long time delay</li> <li>Short time delay/instantaneous</li> <li>Ground fault</li> </ul> | <ul style="list-style-type: none"> <li>N type</li> </ul>  | <ul style="list-style-type: none"> <li>N type</li> </ul>   | <ul style="list-style-type: none"> <li>N type</li> </ul>  |
| Fault recording      | -   | <ul style="list-style-type: none"> <li>10 records (Fault/Current/Date and Time)</li> </ul>  | <ul style="list-style-type: none"> <li>256 records (Fault/Current/Date and Time)</li> </ul>  | <ul style="list-style-type: none"> <li>256 records</li> <li>Last fault wave recording (3 Phase)</li> </ul>  |
| Event recording      | -   | -   | 256 records (Content, Status, Date)  | <ul style="list-style-type: none"> <li>P type</li> </ul>  |
| Operating button     | <ul style="list-style-type: none"> <li>Reset button</li> </ul>  | <ul style="list-style-type: none"> <li>Reset, Menu Up/Down, Left/Right, Enter</li> </ul>  | <ul style="list-style-type: none"> <li>A type</li> </ul>   | <ul style="list-style-type: none"> <li>A type</li> </ul>  |

Basic protection function (L/S/I/G) is still under normal operation without control power.

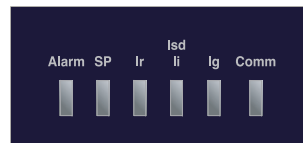
# Trip relays

## N type: Normal type

- Optimized protection function
- OCR, OCGR function according to IEC60947-2
- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay/Instantaneous
  - I<sup>2</sup>t On/Off optional (for short-time delay)
- Ground fault protection
  - I<sup>2</sup>t On/Off optional
- Self -Power



① LED: Indication of trip info. and overload state



- Ig: LED indicating ground-fault
- Isd/li: LED indicating short-time or instantaneous tripping
- Ir: LED indicating long-time delay
- SP: Self-protection and battery test LED
- Alarm: LED indicating an overload  
(Turn on above 90%, Blink above 105%)

② Reset key: Fault reset or battery check

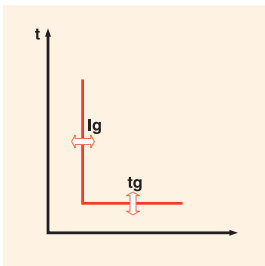
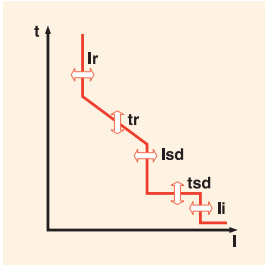
③ lu, lr: Long-time current setting, tr: Long-time tripping delay setting

④ Isd: Short-time current setting, tsd: Short-time tripping delay setting

⑤ li: Instantaneous current setting

⑥ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

⑦ Test terminal: OCR test terminal (Connected with OCR tester)



## Protection

| Long time   |                             |                     |      |      |      |     |      |      |      |     |  |
|---|-----------------------------|---------------------|------|------|------|-----|------|------|------|-----|--|
| Current setting (A)   | $I_u = I_n \times \dots$    | 0.5                 | 0.6  | 0.7  | 0.8  | 0.9 | 1.0  |      |      |     |  |
|   | $I_r = I_u \times \dots$    | 0.8                 | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |  |
| Time delay (s)  | $t_r @ (1.5 \times I_r)$    | 12.5                | 25   | 50   | 100  | 200 | 300  | 400  | 500  | Off |  |
| Accuracy: $\pm 15\%$ or below<br>100ms                                      | $t_r @ (6.0 \times I_r)$    | 0.5                 | 1    | 2    | 4    | 8   | 12   | 16   | 20   | Off |  |
|   | $t_r @ (7.2 \times I_r)$    | 0.34                | 0.69 | 1.38 | 2.7  | 5.5 | 8.3  | 11   | 13.8 | Off |  |
| Short time  |                             |                     |      |      |      |     |      |      |      |     |  |
| Current setting (A)   | $I_{sd} = I_r \times \dots$ | 1.5                 | 2    | 3    | 4    | 5   | 6    | 8    | 10   | Off |  |
| Accuracy: $\pm 10\%$  |                             |                     |      |      |      |     |      |      |      |     |  |
| Time delay (s) @ $10 \times I_r$  | tsd                         | $I^2t$ Off          | 0.05 | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |  |
|   |                             | $I^2t$ On           |      | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |  |
|   | $(I^2t \text{ Off})$        | Min. Trip Time (ms) | 20   | 80   | 160  | 260 | 360  |      |      |     |  |
|   |                             | Max. Trip Time (ms) | 80   | 140  | 240  | 340 | 440  |      |      |     |  |
| Instantaneous   |                             |                     |      |      |      |     |      |      |      |     |  |
| Current setting (A)   | $I_i = I_n \times \dots$    | 2                   | 3    | 4    | 6    | 8   | 10   | 12   | 15   | Off |  |
| Tripping time   |                             | below 50ms          |      |      |      |     |      |      |      |     |  |
| Ground fault  |                             |                     |      |      |      |     |      |      |      |     |  |
| Pick-up (A)   |                             |                     |      |      |      |     |      |      |      |     |  |
| Accuracy: $\pm 10\%$ ( $I_g > 0.4I_n$ )<br>$\pm 20\%$ ( $I_g \leq 0.4I_n$ ) | $I_g = I_n \times \dots$    | 0.2                 | 0.3  | 0.4  | 0.5  | 0.6 | 0.7  | 0.8  | 1.0  | Off |  |
|   |                             |                     |      |      |      |     |      |      |      |     |  |
| Time delay (s) @ $1 \times I_n$   | tg                          | $I^2t$ Off          | 0.05 | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |  |
|   |                             | $I^2t$ On           |      | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |  |
|   | $(I^2t \text{ Off})$        | Min. Trip Time (ms) | 20   | 80   | 160  | 260 | 360  |      |      |     |  |
|   |                             | Max. Trip Time (ms) | 80   | 140  | 240  | 340 | 440  |      |      |     |  |

# Trip relays

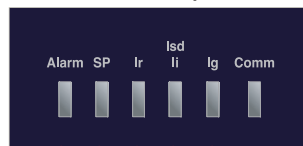
## A type: Ammeter type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay/Instantaneous
  - $I^2t$  On/Off optional (for short-time delay)
- Ground fault protection
  - $I^2t$  On/Off optional
- Realization of protective coordination by ZSI (Zone Selective Intenerlocking)
- High-performance and high-speed MCU built-in
  - Accurate measurement with tolerance of 1.0%
- Fault recording
  - Records Max. up to 10 fault information about fault type, fault phase, fault data, occurrence time of fault
- SBO (Select Before Operation)
  - High reliability for control and setting change method
- 3 DO (Digital Output)
  - Fixed
- Communication
  - Modbus/RS485
  - Profibus-DP



① LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



- Ig: LED indicating ground-fault
- Isd/Ii: LED indicating short-time or instantaneous tripping
- Ir: LED indicating long-time delay
- SP: Self-protection and battery test LED
- Alarm: LED indicating an overload  
(Turn on above 90%, Blink above 105%)

③ Key: Move to menu or reset



- Reset/ESC: Fault reset or ESC from menu
- Enter: Enter into secondary menu or setting input
- Up/Down: Move the cursor up/down on scree or increase/decrease a setting value
- Right/Left: Move the cursor or setting right/left on screen (Rotation)
- Menu: Menu display — Measurement display

④ lu, lr: Long-time current setting, tr: Long-time tripping delay setting

⑤ Isd: Short-time current setting, tsd: Short-time tripping delay setting

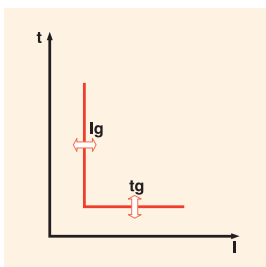
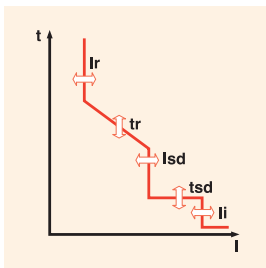
⑥ li: Instantaneous current setting

⑦ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

⑧ Test terminal: OCR test terminal (Connected with OCR tester)



## Protection



| Long time                                |                                   |                     |      |      |      |     |      |      |      |     |  |
|--|-----------------------------------|---------------------|------|------|------|-----|------|------|------|-----|--|
| Current setting (A)                      | $I_u = I_n \times \dots$          | 0.5                 | 0.6  | 0.7  | 0.8  | 0.9 | 1.0  |      |      |     |  |
|  | $I_r = I_u \times \dots$          | 0.8                 | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |  |
| Time delay (s)                           | $t_r @ (1.5 \times I_r)$          | 12.5                | 25   | 50   | 100  | 200 | 300  | 400  | 500  | Off |  |
| Accuracy: $\pm 15\%$ or below            | $t_r @ (6.0 \times I_r)$          | 0.5                 | 1    | 2    | 4    | 8   | 12   | 16   | 20   | Off |  |
| 100ms                                    | $t_r @ (7.2 \times I_r)$          | 0.34                | 0.69 | 1.38 | 2.7  | 5.5 | 8.3  | 11   | 13.8 | Off |  |
| Short time                               |                                   |                     |      |      |      |     |      |      |      |     |  |
| Current setting (A)                      | $I_{sd} = I_r \times \dots$       | 1.5                 | 2    | 3    | 4    | 5   | 6    | 8    | 10   | Off |  |
| Accuracy: $\pm 10\%$                     |                                   |                     |      |      |      |     |      |      |      |     |  |
| Time delay (s) @ $10 \times I_r$         | $t_{sd}$                          | $I^2t$ Off          | 0.05 | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |  |
|  |                                   | $I^2t$ On           |      | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |  |
| $(I^2t \text{ Off})$                     |                                   | Min. Trip Time (ms) | 20   | 80   | 160  | 260 | 360  |      |      |     |  |
|  |                                   | Max. Trip Time (ms) | 80   | 140  | 240  | 340 | 440  |      |      |     |  |
| Instantaneous                            |                                   |                     |      |      |      |     |      |      |      |     |  |
| Current setting (A)                      | $I_l = I_n \times \dots$          | 2                   | 3    | 4    | 6    | 8   | 10   | 12   | 15   | Off |  |
| Tripping time                            |                                   | below 50ms          |      |      |      |     |      |      |      |     |  |
| Ground fault                             |                                   |                     |      |      |      |     |      |      |      |     |  |
| Pick-up (A)                              |                                   |                     |      |      |      |     |      |      |      |     |  |
| Accuracy: $\pm 10\%$ ( $I_g > 0.4 I_n$ ) | $I_g = I_n \times \dots$          | 0.2                 | 0.3  | 0.4  | 0.5  | 0.6 | 0.7  | 0.8  | 1.0  | Off |  |
|  | $\pm 20\%$ ( $I_g \leq 0.4 I_n$ ) |                     |      |      |      |     |      |      |      |     |  |
| Time delay (s) @ $1 \times I_n$          | $t_g$                             | $I^2t$ Off          | 0.05 | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |  |
|  |                                   | $I^2t$ On           |      | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |  |
| $(I^2t \text{ Off})$                     |                                   | Min. Trip Time (ms) | 20   | 80   | 160  | 260 | 360  |      |      |     |  |
|  |                                   | Max. Trip Time (ms) | 80   | 140  | 240  | 340 | 440  |      |      |     |  |
| Earth leakage (Option)                   |                                   |                     |      |      |      |     |      |      |      |     |  |
| Current setting (A)                      | $I_g$                             | 0.5                 | 1    | 2    | 3    | 5   | 10   | 20   | 30   | Off |  |
| Time delay (ms)                          | $t_g$                             | Alarm Time (ms)     | 140  | 230  | 350  | 800 | 950  |      |      |     |  |
|  |                                   | Trip Time (ms)      | 140  | 230  | 350  | 800 |      |      |      |     |  |

Note) Earth leakage function is available with ZCT or external CT

# Trip relays

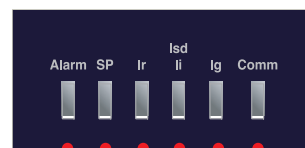
## P type: Power meter type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay/Instantaneous
  - $I^2t$  On/Off optional (for short-time delay)
- Ground fault protection
  - $I^2t$  On/Off optional
- Protection for Over voltage/Under voltage/Over frequency/Under frequency/Unbalance/Reverse power
- Realization of protective coordination by ZSI (Zone Selective Intenerlocking)
- The fine-adjustable setting by knob and Key
- IDML setting (SIT, VIT, EIT, DT curve)
- Measurement and Display Function
  - High detailed measurement for 3 phase current/ Voltage/Power/Energy/Phase angle/Frequency/PF/Demand
  - 128 x 128 Graphic LCD
  - Indicates current/voltage/Vector Diagram and Waveform
- Fault recording
  - Records Max. up to 256 fault information about fault type, fault phases, fault data, occurrence time of fault
- Event recording
  - Records events of device related to setting change, operation and state change. (Max. up to 256)
- SBO (Select Before Operation)
  - High reliability for control and setting change method
- 3 DO (Digital Output)
  - Programmable for alarm, trip and general DO
- Communication
  - Modbus/RS485
  - Profibus-DP



① Graphic LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



- Comm: LED indicating comm. state (Blink when running)
- Ig: LED indicating ground-fault
- Isd/Ii: LED indicating short-time or instantaneous tripping
- Ir: LED indicating long-time delay
- SP: Self-protection and battery test LED
- Alarm: LED indicating an overload (Turn on above 90%, Blink above 105%)

③ Key: Move to menu or reset



- Reset/ESC: Fault reset or ESC from menu
- Enter: Enter into secondary menu or setting input
- Up/Down: Move the cursor up/down on screen or increase/decrease a setting value
- Right/Left: Move the cursor or setting right/left on screen (Rotation)
- Menu: Menu display — Measurement display

④ Ir: Long-time current setting, tr: Long-time tripping delay setting

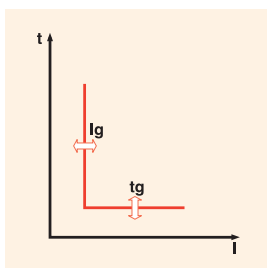
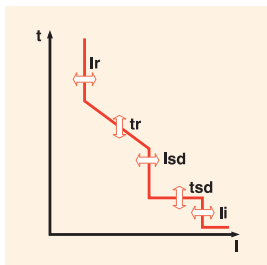
⑤ Isd: Short-time current setting, tsd: Short-time tripping delay setting

⑥ Ii: Instantaneous current setting

⑦ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

⑧ Test terminal: OCR test terminal (Connected with OCR tester)

## Protection



| Long time                                |                             |                     |      |      |     |     |     |     |      |     |  |
|--|-----------------------------|---------------------|------|------|-----|-----|-----|-----|------|-----|--|
| Current setting (A)                      | $I_r = I_u \times \dots$    | 0.4                 | 0.5  | 0.6  | 0.7 | 0.8 | 0.9 | 1.0 |      |     |  |
| Time delay (s)                           | $t_r @ (1.5 \times I_r)$    | 12.5                | 25   | 50   | 100 | 200 | 300 | 400 | 500  | Off |  |
| Accuracy: $\pm 15\%$ or below            | $t_r @ (6.0 \times I_r)$    | 0.5                 | 1    | 2    | 4   | 8   | 12  | 16  | 20   | Off |  |
| 100ms                                    | $t_r @ (7.2 \times I_r)$    | 0.34                | 0.69 | 1.38 | 2.7 | 5.5 | 8.3 | 11  | 13.8 | Off |  |
| Short time                               |                             |                     |      |      |     |     |     |     |      |     |  |
| Current setting (A)                      | $I_{sd} = I_r \times \dots$ | 1.5                 | 2    | 3    | 4   | 5   | 6   | 8   | 10   | Off |  |
| Accuracy: $\pm 10\%$                     |                             |                     |      |      |     |     |     |     |      |     |  |
| Time delay (s) @ $10 \times I_r$         | $t_{sd}$                    | $I^2t$ Off          | 0.05 | 0.1  | 0.2 | 0.3 | 0.4 |     |      |     |  |
|  |                             | $I^2t$ On           |      | 0.1  | 0.2 | 0.3 | 0.4 |     |      |     |  |
| $(I^2t \text{ Off})$                     |                             | Min. Trip Time (ms) | 20   | 80   | 160 | 260 | 360 |     |      |     |  |
|  |                             | Max. Trip Time (ms) | 80   | 140  | 240 | 340 | 440 |     |      |     |  |
| Instantaneous                            |                             |                     |      |      |     |     |     |     |      |     |  |
| Current setting (A)                      | $I_i = I_n \times \dots$    | 2                   | 3    | 4    | 6   | 8   | 10  | 12  | 15   | Off |  |
| Tripping time                            |                             | below 50ms          |      |      |     |     |     |     |      |     |  |
| Ground fault                             |                             |                     |      |      |     |     |     |     |      |     |  |
| Pick-up (A)                              |                             |                     |      |      |     |     |     |     |      |     |  |
| Accuracy: $\pm 10\%$ ( $I_g > 0.4 I_n$ ) | $I_g = I_n \times \dots$    | 0.2                 | 0.3  | 0.4  | 0.5 | 0.6 | 0.7 | 0.8 | 1.0  | Off |  |
| $\pm 20\%$ ( $I_g \leq 0.4 I_n$ )        |                             |                     |      |      |     |     |     |     |      |     |  |
| Time delay (s) @ $1 \times I_n$          | $t_g$                       | $I^2t$ Off          | 0.05 | 0.1  | 0.2 | 0.3 | 0.4 |     |      |     |  |
|  |                             | $I^2t$ On           |      | 0.1  | 0.2 | 0.3 | 0.4 |     |      |     |  |
| $(I^2t \text{ Off})$                     |                             | Min. Trip Time (ms) | 20   | 80   | 160 | 260 | 360 |     |      |     |  |
|  |                             | Max. Trip Time (ms) | 80   | 140  | 240 | 340 | 440 |     |      |     |  |

| Earth leakage (Option) |       |                 |     |     |     |     |     |    |    |     |  |
|------------------------|-------|-----------------|-----|-----|-----|-----|-----|----|----|-----|--|
| Current setting (A)    | $I_g$ | 0.5             | 1   | 2   | 3   | 5   | 10  | 20 | 30 | Off |  |
| Time delay (ms)        | $t_g$ | Alarm Time (ms) | 140 | 230 | 350 | 800 | 950 |    |    |     |  |
|                        |       | Trip Time (ms)  | 140 | 230 | 350 | 800 |     |    |    |     |  |
| Accuracy: $\pm 15\%$   |       |                 |     |     |     |     |     |    |    |     |  |

Note) Earth leakage function is available with ZCT or external CT

| PTA (Pre Trip Alarm) |                          |     |      |     |      |     |      |     |      |     |
|----------------------|--------------------------|-----|------|-----|------|-----|------|-----|------|-----|
| Current setting (A)  | $I_p = I_r \times \dots$ | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | 1   |
| Time delay (s)       | $t_p @ (1.2 \times I_p)$ | 1   | 5    | 10  | 15   | 20  | 25   | 30  | 35   | Off |
| Accuracy: $\pm 15\%$ |                          |     |      |     |      |     |      |     |      |     |

| Other protection  | Pick-up                |      |                                | Time delay (S) |        |              |
|-------------------|------------------------|------|--------------------------------|----------------|--------|--------------|
|                   | Setting range          | Step | Accuracy                       | Setting range  | Step   | Accuracy     |
| Under voltage     | 80V – 0V_Pick-up       | 1V   | $\pm 5\%$                      | 1.2 – 40sec    | 0.1sec | $\pm 0.1sec$ |
| Over voltage      | UV_Pick-up – 980V      | 1V   | $\pm 5\%$                      |                |        |              |
| Voltage unbalance | 6% – 99%               | 1%   | $\pm 2.5\%$ or ( $*\pm 10\%$ ) |                |        |              |
| Reverse power     | 10 – 500kW             | 1kW  | $\pm 10\%$                     | 0.2 – 40sec    |        |              |
| Over power        | 500 – 5,000kW          | 1kW  | $\pm 10\%$                     |                |        |              |
| Current unbalance | 6% – 99%               | 1%   | $\pm 2.5\%$ or ( $*\pm 10\%$ ) | 1.2 – 40sec    |        |              |
| Over frequency    | 60Hz UF_Pick-up – 65   | 1Hz  | $\pm 0.1Hz$                    |                |        |              |
|                   | 50Hz UF_Pick-up – 55   | 1Hz  | $\pm 0.1Hz$                    |                |        |              |
| Under frequency   | 60Hz 55Hz – OF_Pick-up | 1Hz  | $\pm 0.1Hz$                    |                |        |              |
|                   | 50Hz 45Hz – OF_Pick-up | 1Hz  | $\pm 0.1Hz$                    |                |        |              |

# Trip relays

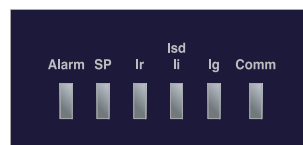
## S type: Supreme meter type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay/ Instantaneous
  - $I^2t$  On/Off optional (for short-time delay)
- Ground fault protection
  - $I^2t$  On/Off optional
- Protection for Over voltage/Under voltage/Over frequency/Under frequency/Unbalance/Reverse power
- Realization of protective coordination by ZSI (Zone Selective Intenerlocking)
- The fine-adjustable setting by knob and Key
- IDML setting (SIT, VIT, EIT, DT curve)
- Measurement and Display Function
  - High detailed measurement for 3 phase current/ Voltage/Power/Energy/Phase angle/Frequency/PF/Demand
  - 128 x 128 Graphic LCD
  - Indicates current/voltage Vector Diagram and Waveform
- Fault recording
  - Records Max. up to 256 fault information about fault type, fault phases, fault data, occurrence time of fault
  - Fault wave recording: records the latest fault wave
- Event recording
  - Records events of device related to setting change, operation and state change. (Max. up to 256)
- SBO (Select Before Operation)
  - High reliability for control and setting change method
- Power quality analysis
  - Measurement for 1st – 63th harmonics
  - THD, TDD, k-Factor
- 3 DO (Digital Output)
  - Programmable for alarm, trip and general DO
- Communication
  - Modbus/RS485
  - Profibus-DP



① Graphic LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



- Comm: LED indicating comm. state (Blink when running)
- Ig: LED indicating ground-fault
- Isd/li: LED indicating short-time or instantaneous tripping
- Ir: LED indicating long-time delay
- SP: Self-protection and battery test LED
- Alarm: LED indicating an overload (Turn on above 90%, Blink above 105%)

③ Key: Move to menu or reset



- Reset/ESC: Fault reset or ESC from menu
- Enter: Enter into secondary menu or setting input
- Up/Down: Move the cursor up/down on screen or increase/decrease a setting value
- Right/Left: Move the cursor or setting right/left on screen (Rotation)
- Menu: Menu display — Measurement display

④ Ir: Long-time current setting, tr: Long-time tripping delay setting

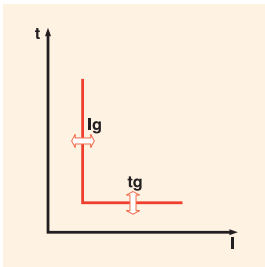
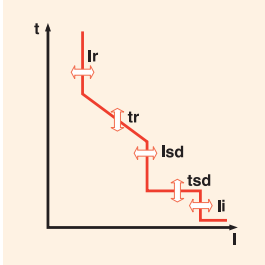
⑤ Isd: Short-time current setting, tsd: Short-time tripping delay setting

⑥ li: Instantaneous current setting

⑦ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

⑧ Test terminal: OCR test terminal (Connected with OCR tester)

## Protection



| Long time                                |                             |            |      |      |     |     |     |     |      |     |  |
|--|-----------------------------|------------|------|------|-----|-----|-----|-----|------|-----|--|
| Current setting (A)                      | $I_r = I_u \times \dots$    | 0.4        | 0.5  | 0.6  | 0.7 | 0.8 | 0.9 | 1.0 |      |     |  |
| Time delay (s)                           | $t_r @ (1.5 \times I_r)$    | 12.5       | 25   | 50   | 100 | 200 | 300 | 400 | 500  | Off |  |
| Accuracy: $\pm 15\%$ or below            | $t_r @ (6.0 \times I_r)$    | 0.5        | 1    | 2    | 4   | 8   | 12  | 16  | 20   | Off |  |
| 100ms                                    | $t_r @ (7.2 \times I_r)$    | 0.34       | 0.69 | 1.38 | 2.7 | 5.5 | 8.3 | 11  | 13.8 | Off |  |
| Short time                               |                             |            |      |      |     |     |     |     |      |     |  |
| Current setting (A)                      | $I_{sd} = I_r \times \dots$ | 1.5        | 2    | 3    | 4   | 5   | 6   | 8   | 10   | Off |  |
| Accuracy: $\pm 10\%$                     |                             |            |      |      |     |     |     |     |      |     |  |
| Time delay (s) @ $10 \times I_r$         | $t_{sd}$                    | $I^2t$ Off | 0.05 | 0.1  | 0.2 | 0.3 | 0.4 |     |      |     |  |
|  |                             | $I^2t$ On  |      | 0.1  | 0.2 | 0.3 | 0.4 |     |      |     |  |
| $(I^2t$ Off)                             | Min. Trip Time (ms)         |            | 20   | 80   | 160 | 260 | 360 |     |      |     |  |
|  | Max. Trip Time (ms)         |            | 80   | 140  | 240 | 340 | 440 |     |      |     |  |
| Instantaneous                            |                             |            |      |      |     |     |     |     |      |     |  |
| Current setting (A)                      | $I_i = I_n \times \dots$    | 2          | 3    | 4    | 6   | 8   | 10  | 12  | 15   | Off |  |
| Tripping time                            |                             | below 50ms |      |      |     |     |     |     |      |     |  |
| Ground fault                             |                             |            |      |      |     |     |     |     |      |     |  |
| Pick-up (A)                              |                             |            |      |      |     |     |     |     |      |     |  |
| Accuracy: $\pm 10\%$ ( $I_g > 0.4 I_n$ ) | $I_g = I_n \times \dots$    | 0.2        | 0.3  | 0.4  | 0.5 | 0.6 | 0.7 | 0.8 | 1.0  | Off |  |
| $\pm 20\%$ ( $I_g \leq 0.4 I_n$ )        |                             |            |      |      |     |     |     |     |      |     |  |
| Time delay (s) @ $1 \times I_n$          | $t_g$                       | $I^2t$ Off | 0.05 | 0.1  | 0.2 | 0.3 | 0.4 |     |      |     |  |
|  |                             | $I^2t$ On  |      | 0.1  | 0.2 | 0.3 | 0.4 |     |      |     |  |
| $(I^2t$ Off)                             | Min. Trip Time (ms)         |            | 20   | 80   | 160 | 260 | 360 |     |      |     |  |
|  | Max. Trip Time (ms)         |            | 80   | 140  | 240 | 340 | 440 |     |      |     |  |

| Earth leakage (Option) |       |                 |     |     |     |     |     |    |    |     |  |
|------------------------|-------|-----------------|-----|-----|-----|-----|-----|----|----|-----|--|
| Current setting (A)    | $I_g$ | 0.5             | 1   | 2   | 3   | 5   | 10  | 20 | 30 | Off |  |
| Time delay (ms)        | $t_g$ | Alarm Time (ms) | 140 | 230 | 350 | 800 | 950 |    |    |     |  |
|                        |       | Trip Time (ms)  | 140 | 230 | 350 | 800 |     |    |    |     |  |
| Accuracy: $\pm 15\%$   |       |                 |     |     |     |     |     |    |    |     |  |

(Note) Earth leakage function is available with ZCT or external CT

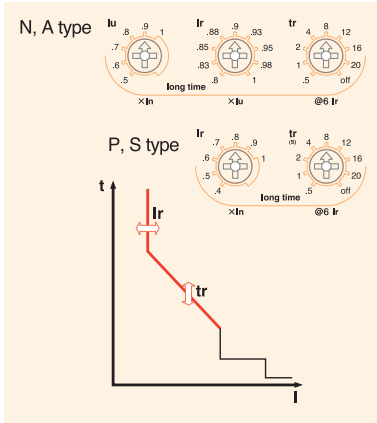
| PTA (Pre Trip Alarm) |                          |     |      |     |      |     |      |     |      |     |
|----------------------|--------------------------|-----|------|-----|------|-----|------|-----|------|-----|
| Current setting (A)  | $I_p = I_r \times \dots$ | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | 1   |
| Time delay (s)       | $t_p @ (1.2 \times I_p)$ | 1   | 5    | 10  | 15   | 20  | 25   | 30  | 35   | Off |
| Accuracy: $\pm 15\%$ |                          |     |      |     |      |     |      |     |      |     |

| Other protection  | Pick-up           |                   |                                | Time delay (S) |             |              |
|-------------------|-------------------|-------------------|--------------------------------|----------------|-------------|--------------|
|                   | Setting range     | Step              | Accuracy                       | Setting range  | Step        | Accuracy     |
| Under voltage     | 80V – 0V_Pick-up  | 1V                | $\pm 5\%$                      | 1.2 – 40sec    | 0.1sec      | $\pm 0.1sec$ |
| Over voltage      | UV_Pick-up – 980V | 1V                | $\pm 5\%$                      |                |             |              |
| Voltage unbalance | 6% – 99%          | 1%                | $\pm 2.5\%$ or ( $*\pm 10\%$ ) |                |             |              |
| Reverse power     | 10 – 500kW        | 1kW               | $\pm 10\%$                     | 0.2 – 40sec    |             |              |
| Over power        | 500 – 5,000kW     | 1kW               | $\pm 10\%$                     |                |             |              |
| Current unbalance | 6% – 99%          | 1%                | $\pm 2.5\%$ or ( $*\pm 10\%$ ) | 1.2 – 40sec    |             |              |
| Over frequency    | 60Hz              | UF_Pick-up – 65   | 1Hz                            |                | $\pm 0.1Hz$ |              |
|                   | 50Hz              | UF_Pick-up – 55   | 1Hz                            |                | $\pm 0.1Hz$ |              |
| Under frequency   | 60Hz              | 55Hz – OF_Pick-up | 1Hz                            |                | $\pm 0.1Hz$ |              |
|                   | 50Hz              | 45Hz – OF_Pick-up | 1Hz                            | $\pm 0.1Hz$    |             |              |

# Trip relays

## Operation characteristic

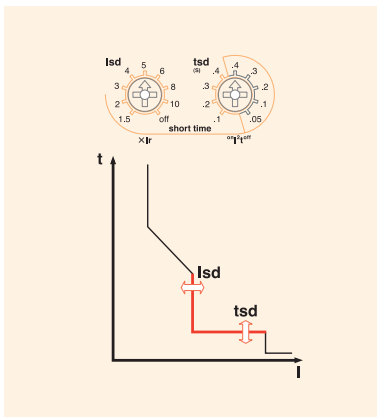
### Long-time delay (L)



The function for overload protection which has time delayed characteristic in inverse ratio to fault current.

- Standard current setting knob:  $I_r$ 
  - Setting range in P type and S type:  $(0.4-0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
  - Setting range in N type and A type:  $(0.4 - 1.0) \times I_n$ 
    - $I_u$ :  $(0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
    - $I_r$ :  $(0.8-0.83-0.85-0.88-0.9-0.93-0.95-0.98-1.0) \times I_u$
- Time delay setting knob:  $t_r$ 
  - Standard operating time is based on the time of  $6 \times I_r$
  - Setting range: 0.5-1-2-4-8-12-16-20-l-Off sec (9 modes)
- Relay pick-up current
  - When current over  $(1.15) \times I_r$  flows in, relay is picked up.
- Relay operates basing on the largest load current amount R/S/T/N phase.

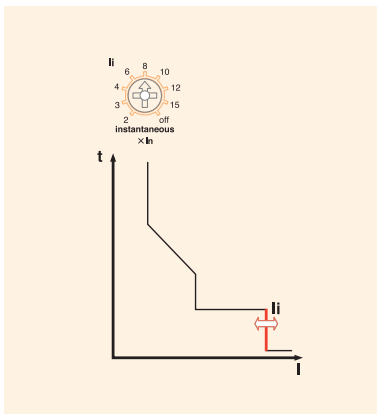
### Short-time delay (S)



The function for fault current (over current) protection which has definite time characteristic and time delayed in inverse ratio to fault current.

- Standard current setting knob:  $I_{sd}$ 
  - Setting range:  $(1.5-2-3-4-5-6-8-10-Off) \times I_r$
- Time delay setting knob:  $t_{sd}$ 
  - Standard operating time is based on the time of  $10 \times I_r$
  - Inverse time ( $I^2t$  On) : 0.1-0.2-0.3-0.4 sec
  - Definite time ( $I^2t$  Off) : 0.05-0.1-0.2-0.3-0.4 sec
- Relay operates basing on the largest load current amount R/S/T/N phase.
- Relay can operate at instantaneous current through ZSI.

### Instantaneous (I)



The function for breaking fault current above the setting value within the shortest time to protect the circuit from short-circuit.

- Standard current setting knob:  $I_i$ 
  - Setting range:  $(2-3-4-6-8-10-12-15-Off) \times I_n$
- Relay operates basing on the largest load current amount R/S/T/N phase.
- Total breaking time is below 50ms.



# Trip relays

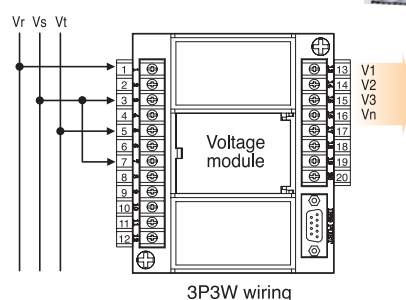
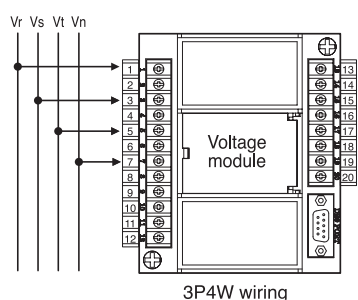
## Measurement function

|                | Class.                | Measurement element                            | Detailed element                   | Unit                  | Display range      | Accuracy |
|----------------|-----------------------|--|------------------------------------|-----------------------|--------------------|----------|
| A type         | Current               | Line current                                   | Ia, Ib, Ic                         | A                     | 80A – 65,535A      | ±3%      |
|                |                       | Normal current                                 | I <sub>1</sub>                     |                       |                    |          |
|                |                       | Reverse current                                | I <sub>2</sub>                     |                       |                    |          |
|                | Voltage               | Line voltage                                   | Vab, Vbc, Vca                      | V                     | 60 – 690V          | ±1%      |
|                |                       | Phase voltage                                  | Va, Vb, Vc                         |                       |                    | ±1%      |
|                |                       | Normal voltage                                 | V <sub>1</sub>                     |                       |                    |          |
|                |                       | Reverse voltage                                | V <sub>2</sub>                     |                       |                    |          |
|                | Angle                 | Line-to-line                                   | ∠Vabla, ∠Vablbc, ∠Vablc,           | °                     | 0 – 360°           | ±1°      |
|                |                       | Line-to-current                                | ∠VabVbc, ∠VabVca                   |                       |                    | ±1°      |
|                |                       | Phase-to-phase                                 | ∠VaVb, ∠VaVc                       |                       |                    | ±1°      |
|                | Power                 | Active power                                   | Pa(ab), Pb(bc), Pc(ca), P          | kW                    | 1kW – 99,999kW     | ±3%      |
|                |                       | Reactive power                                 | Qa(ab), Qb(bc), Qc(ca), Q          | kVar                  | 1kVar – 99,999kVar | ±3%      |
| Apparent power |                       | Sa(ab), Sb(bc), Sc(ca), S                      | kVa                                | 1kVA – 99,999kVA      | ±3%                |          |
| Energy         | Active energy         | WHa(ab), WHb(bc), WHc(ca), WH                  | kWh<br>MWh                         | 1kWh – 9999.99MWh     | ±3%                |          |
|                | Reactive energy       | VARHa(ab), VARHb(bc), VARHc(ca), VARH          | kVarh<br>Mvarh                     | 1kVarh – 9999.99MVarh | ±3%                |          |
|                | Reverse active energy | rWHa(ab), rWHb(bc), rWHc(ca), rWH              | kWh<br>MWh                         | 1kW h– 9999.99MWh     | ±3%                |          |
| Freq.          | Frequency             | F  | Hz                                 | 45 – 65Hz             |                    |          |
| Power factor   | Power factor (PF)     | PFa(ab), PFb(bc), PFc(ca), PF                  |                                    | + : Lead, - : Lag     |                    |          |
| Unvalance      | Unbalance rate        | Iunalance, Vunbalance                          | %                                  | 0.0 – 100.0           |                    |          |
| Demand         | Active power demand   | Peak demand                                    | kW                                 | 1kW – 99,999kW        |                    |          |
|                | Current demand        | 1st – 63th harmonics of Va(ab), Vb(bc), Vc(ca) | A                                  | 80A – 65,535A         |                    |          |
| S type         | Harmonics             | Voltage harmonics                              | 1st – 63th harmonics of Ia, Ib, Ic | V                     | 60 – 690V          |          |
|                |                       | Current harmonics                              |                                    | A                     | 80A – 65,535A      |          |
|                |                       | THD, TDD                                       |                                    | %                     | 0.0 – 100.0        |          |
|                |                       | K-Factor                                       |                                    | -                     | 0.0 – 100.0        |          |

### Voltage module

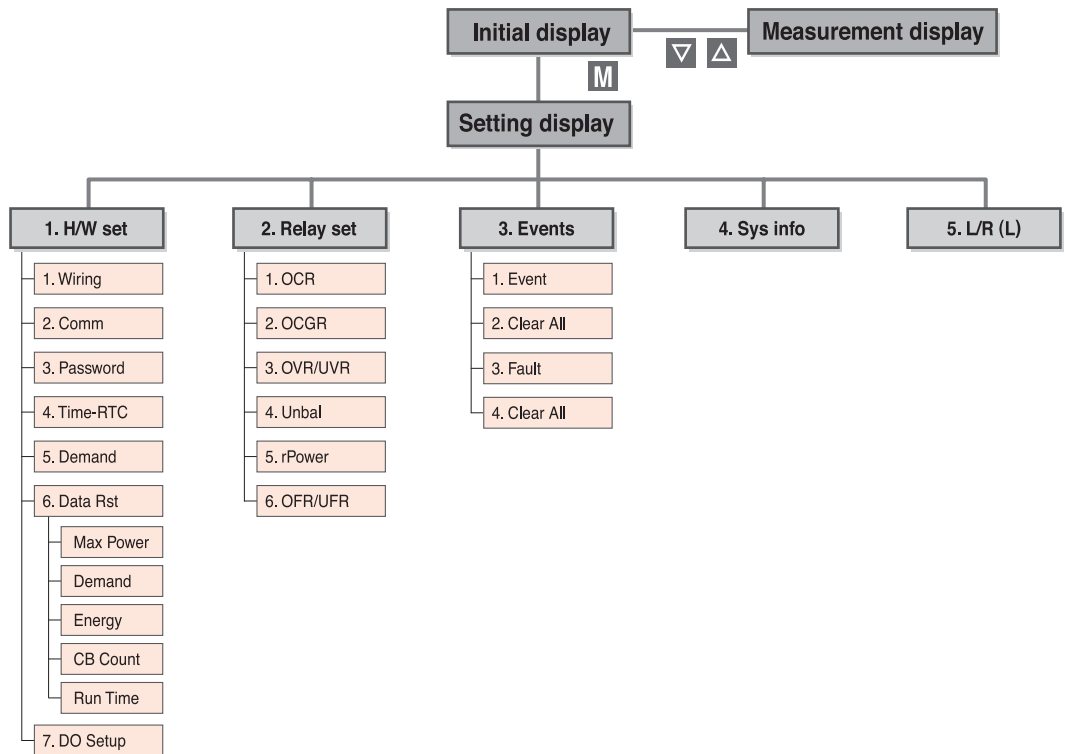
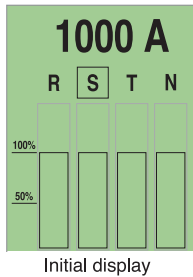
For P and S type Trip relay, separate voltage module is provided to measure other element besides current

- Voltage input range: AC 60 – 690V

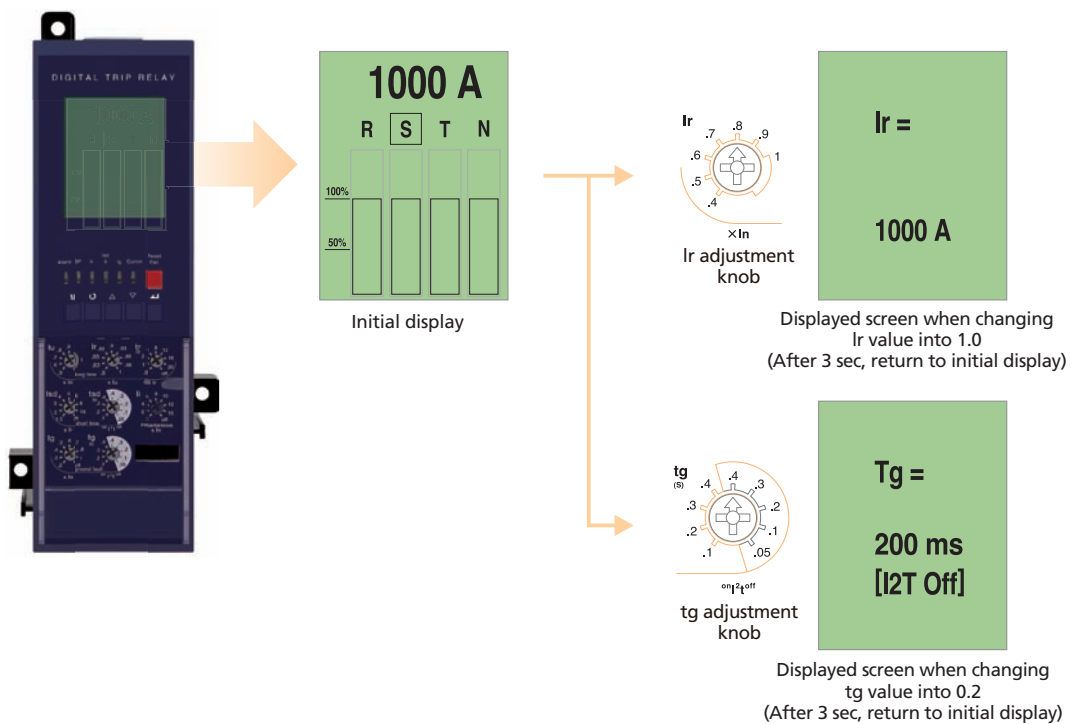




## Man machine interface

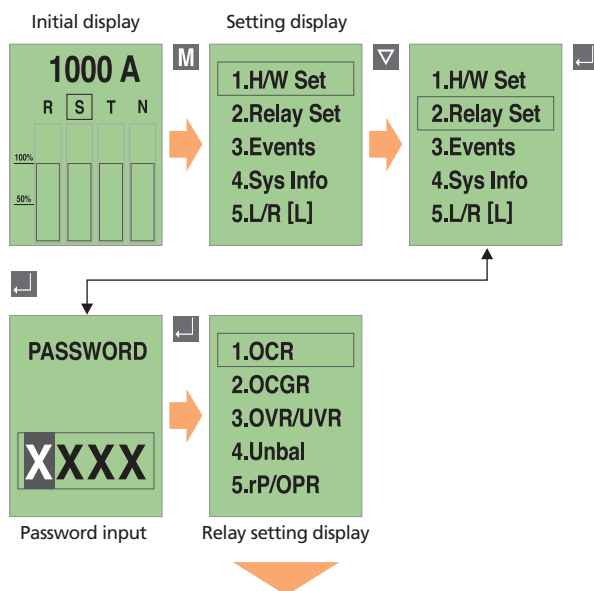


## An example of graphic LCD display



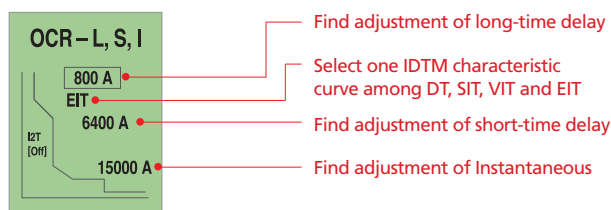
# Trip relays

## Protection element setting

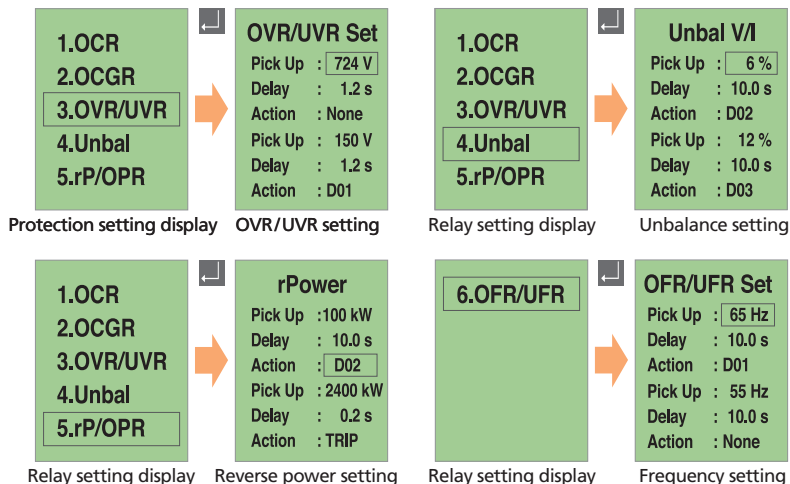
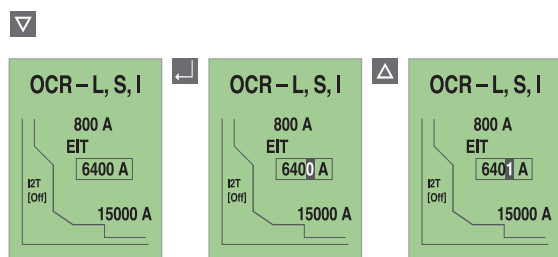


## Find adjustment of protection setting current

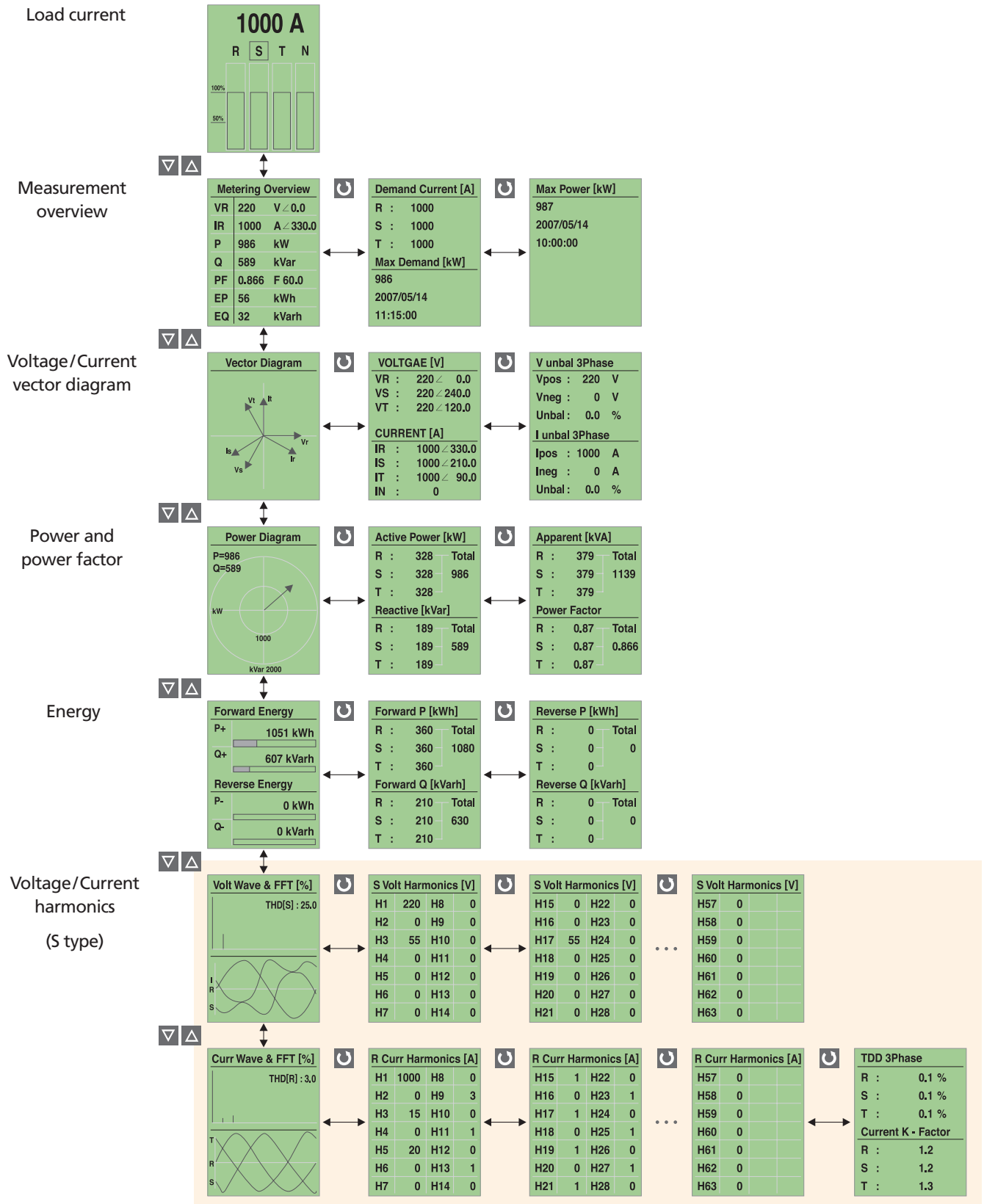
- OCR and OCGR's current setting is basically controlled by knob's setting values.
- The fine current that cannot be controlled by knob is adjustable by using  $\nabla$ ,  $\triangle$  key.
- Fine adjustment is only adjustable in the present knob and next nob's setting range, when moving knob, the adjusted data becomes reset state.



- The setting method of OCGR is same with OCR's fine adjustment is available.



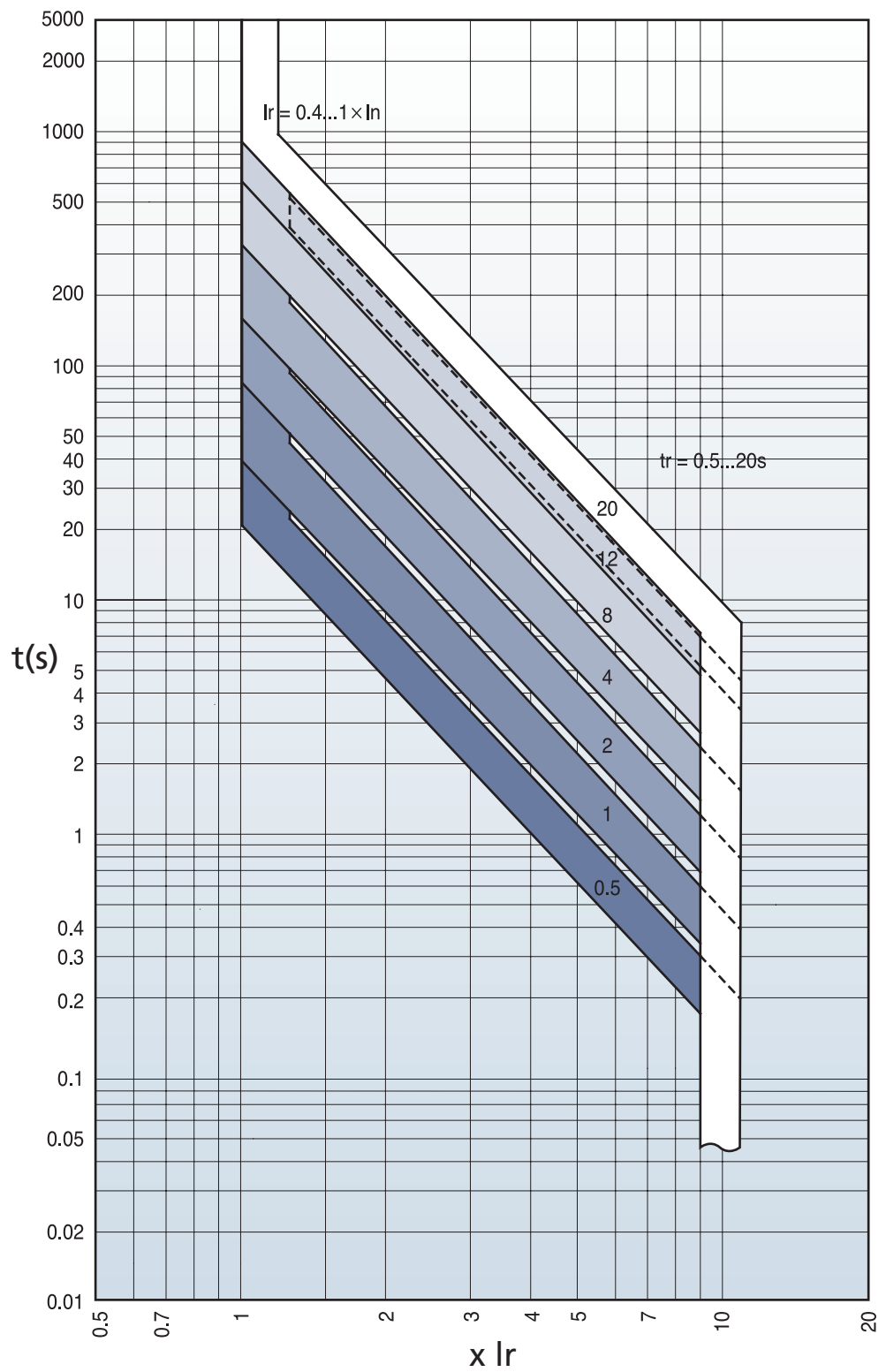
# Measurement element display



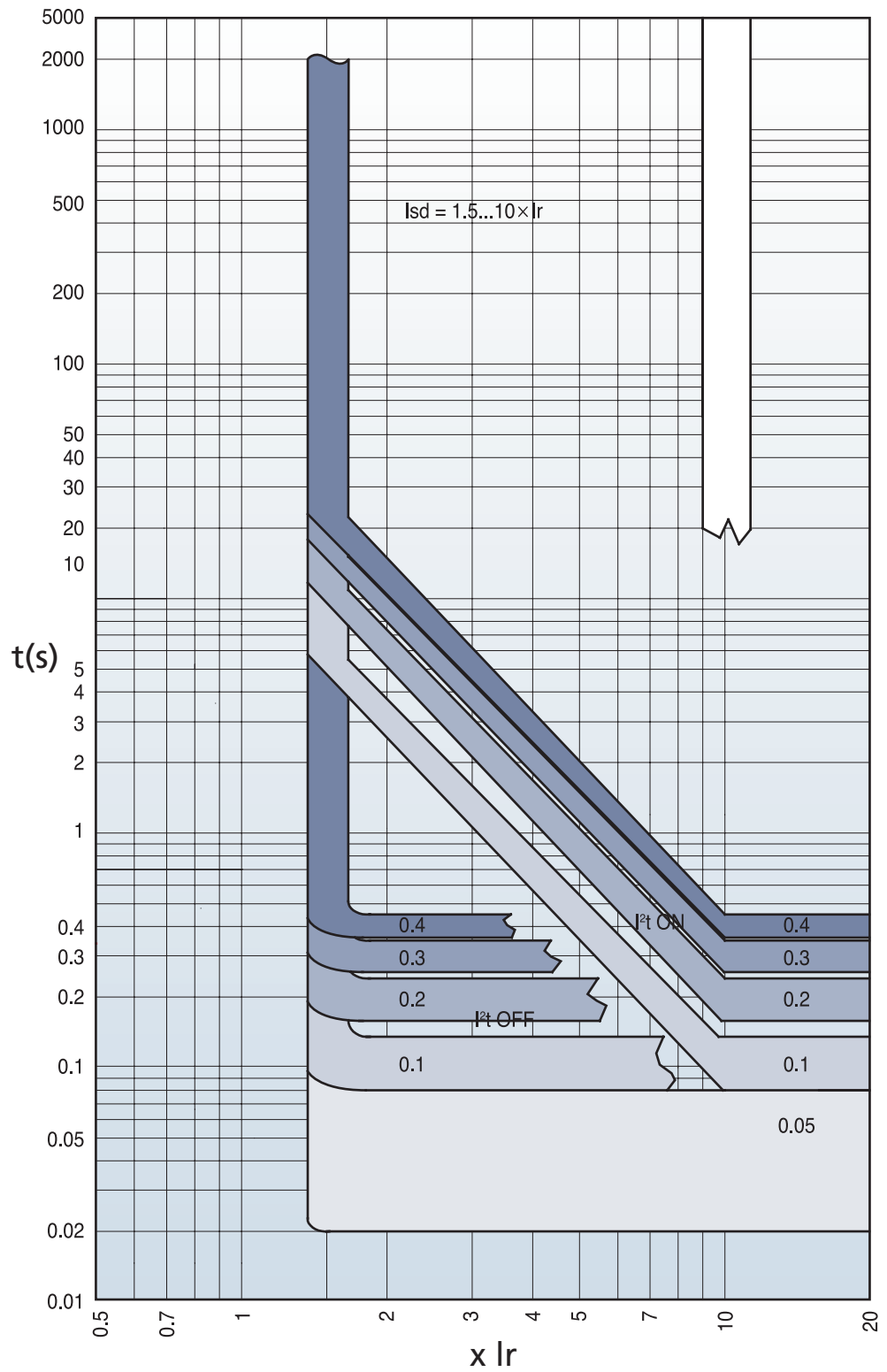
# Trip relays

## Characteristic curves

Long-time delay (L)



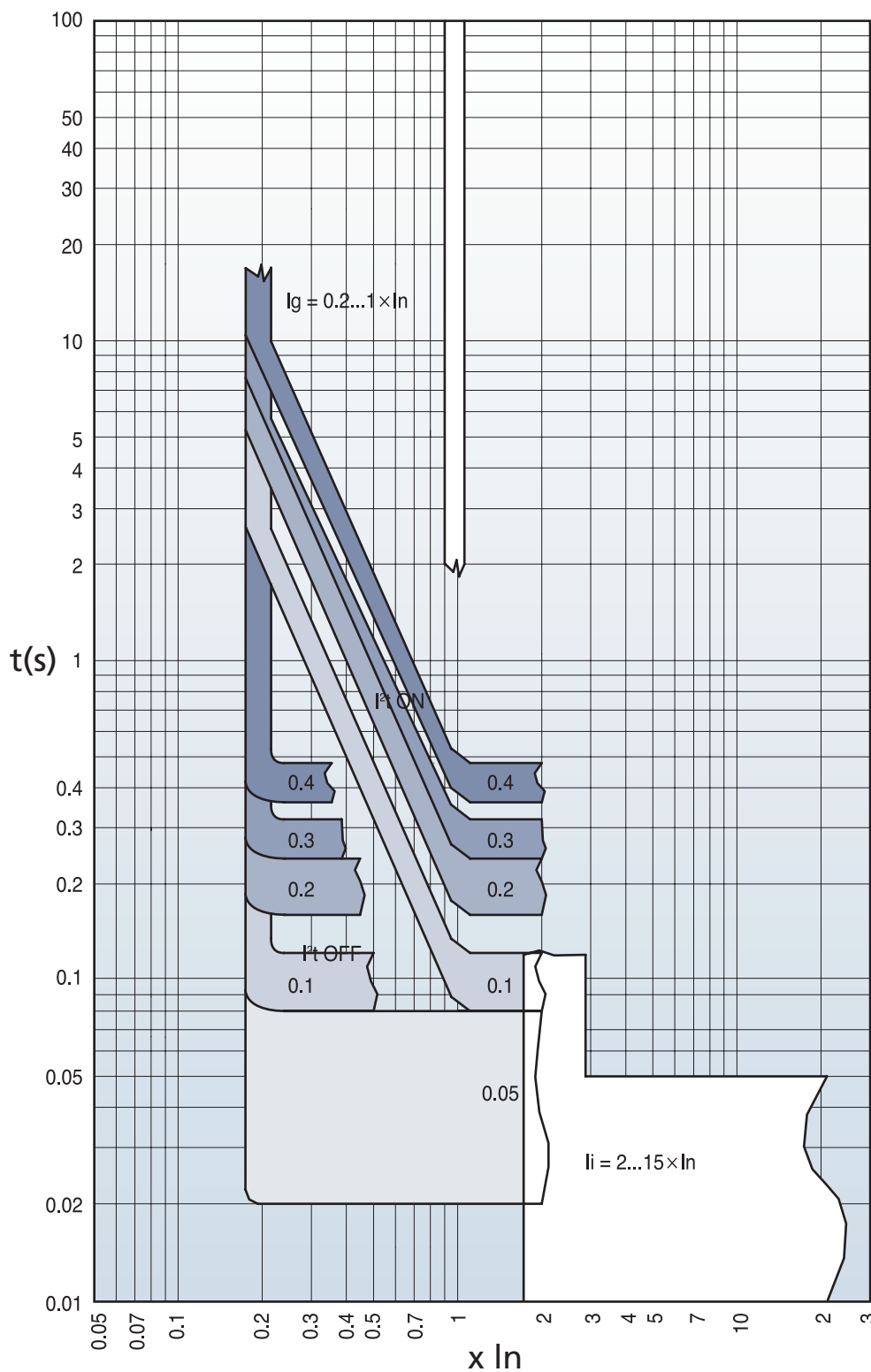
## Short-time delay (S)



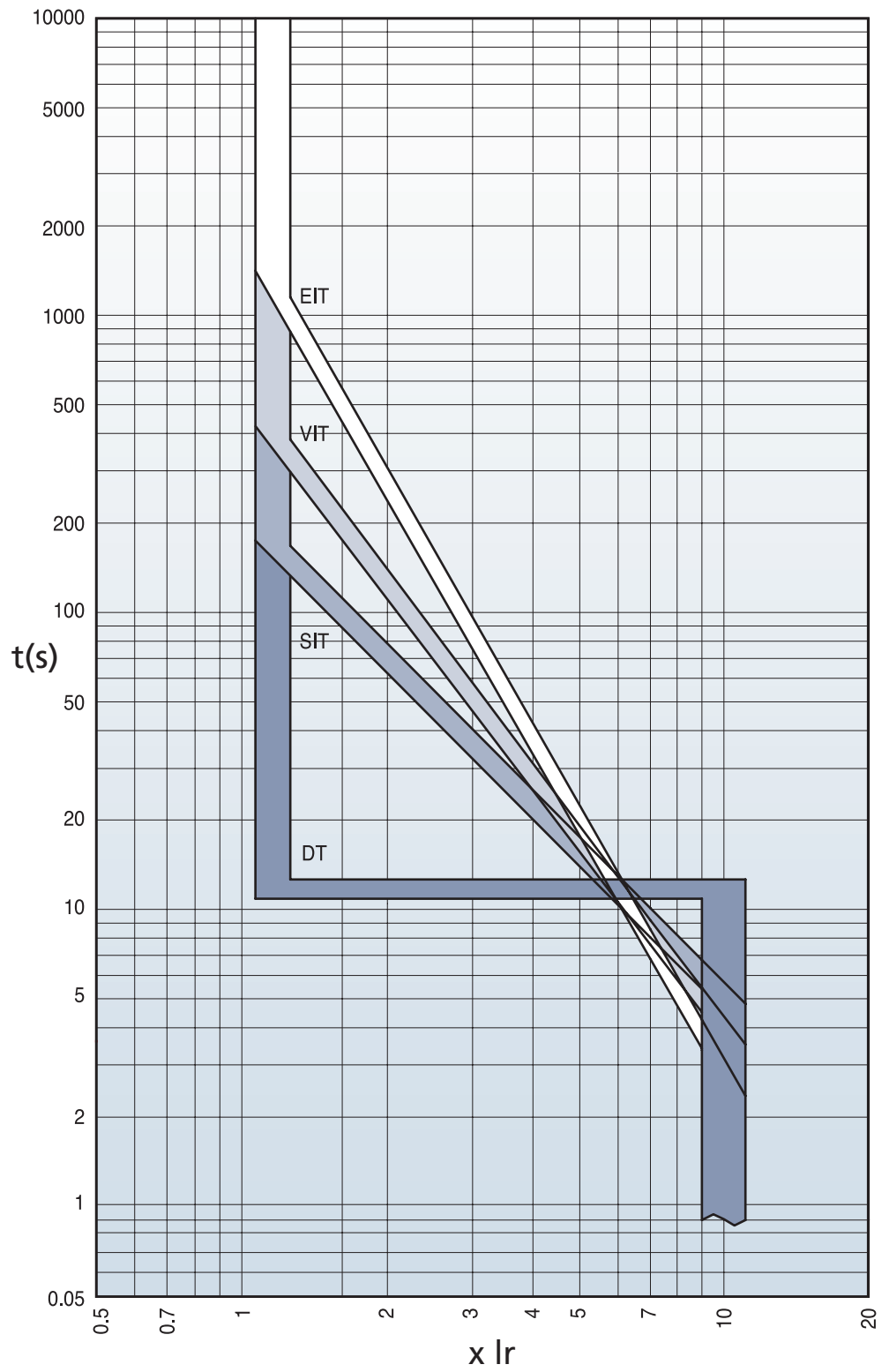
# Trip relays

## Characteristic curves

Instantaneous (I)  
Ground fault (G)



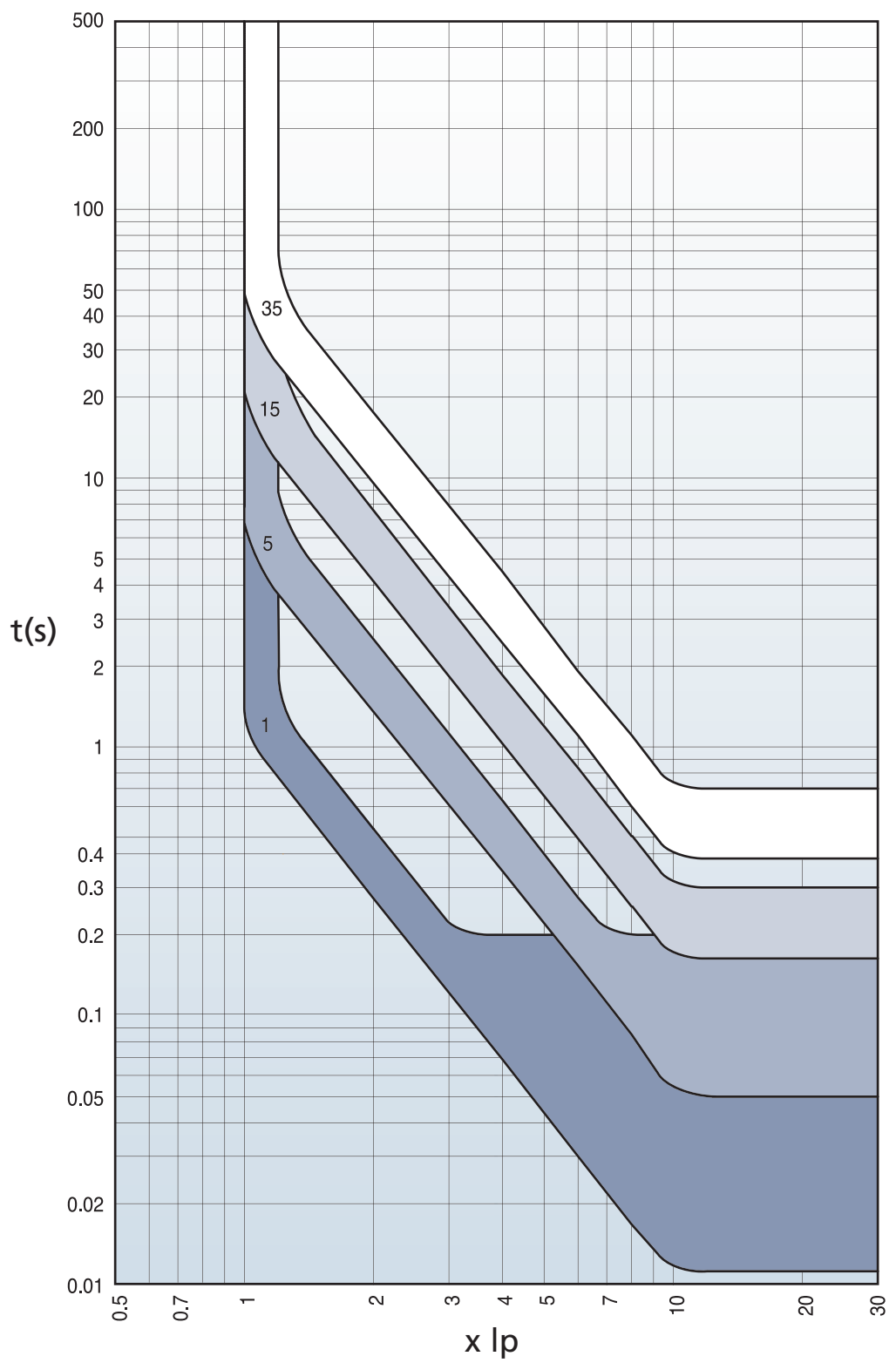
# IDMTL



# Trip relays

## Characteristic curves

Pre Trip Alarm

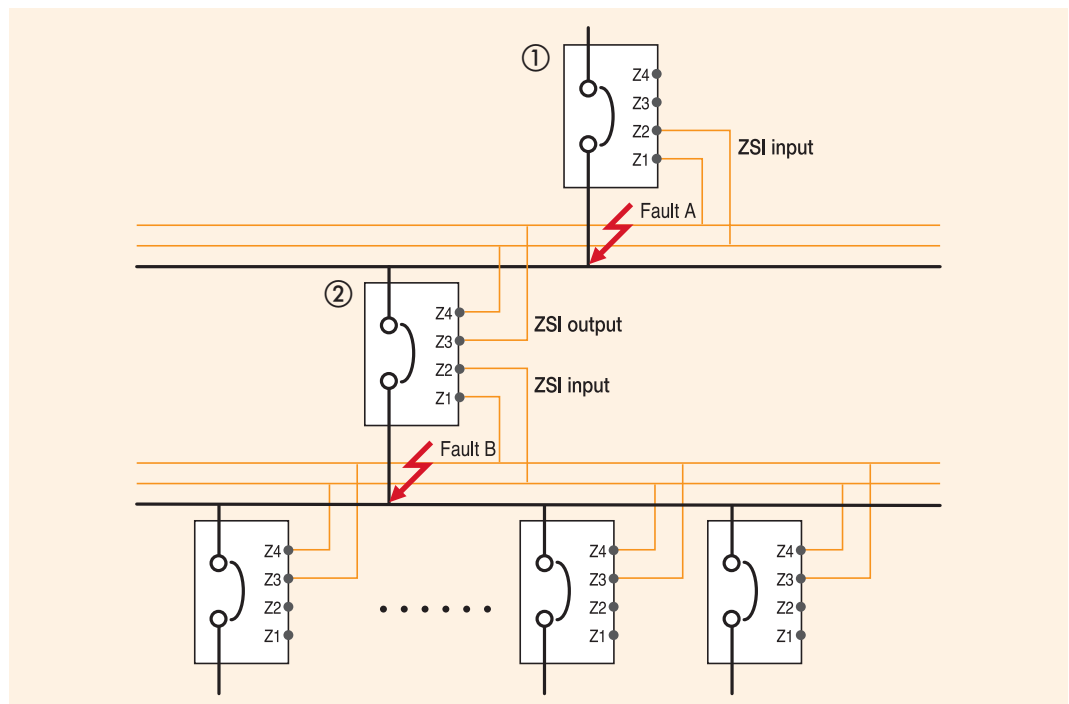




## ZSI - Zone Selective Interlocking (A, P, S type)

Zone-selective interlocking drops delay time that eliminates faults for breakers. It minimizes the shock that all kinds of electric machineries get under fault conditions.

1. In case of that short time-delay or ground fault accident occurs at ZSI built in system, the breaker at accident site sends ZSI signal to halt upstream breaker's operation.
2. To eliminate a breakdown, trip relay of ACB at accident site activates trip operation without time delay.
3. The upstream breaker that received ZSI signal adhere to pre-set short time-delay or ground fault time-delay for protective coordination in the system. However upstream breaker that did not receive its signal will trip instantaneously.
4. For ordinary ZSI operation, it should arrange operation time accordingly so that downstream circuit breakers will react before upstream ones under overcurrent/short time delay/ground fault situations.
5. ZSI connecting line needs to be Max. 3m.



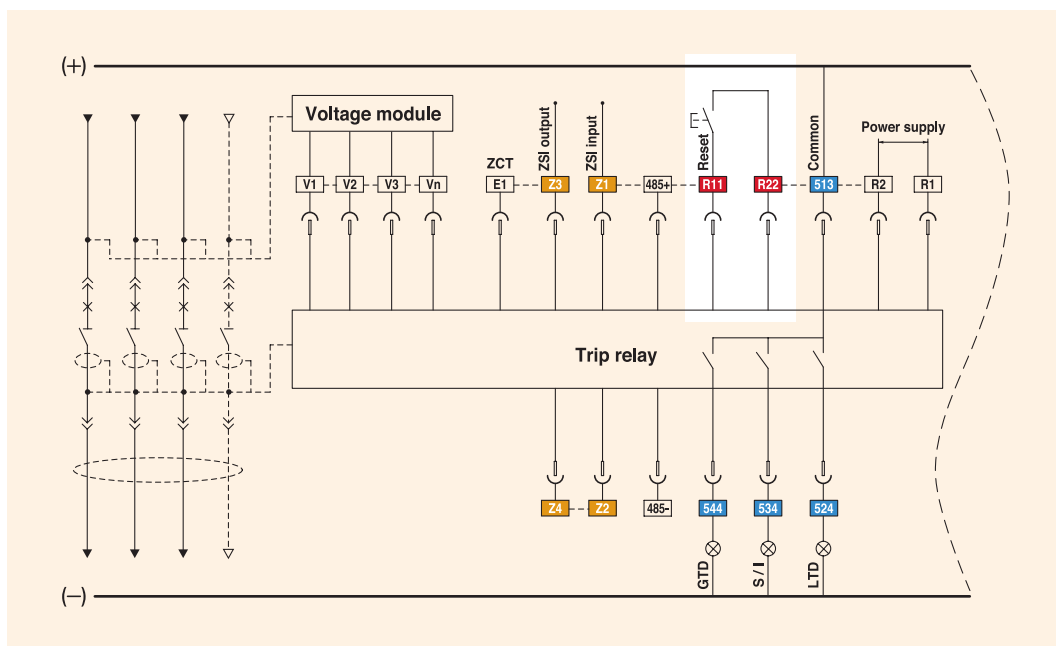
- 1) Occurrence of fault A
  - Only breaker ① performs instantaneous trip operation.
- 2) Occurrence of fault B
  - Breaker ② performs instantaneous trip operation, breaker ① performs trip operation after prearranged delay time
  - But if breaker ② did not break the fault normally, breaker ① performs instantaneous trip operation to protect system.

# Trip relays

## Remote reset and digital I/O (A, P, S type)

In case of that ACB operates due to accidents or over current, Trip relay indicates the information of the accident through the LED and LCD. Trip relay A, P and S type is possible to perform the remote reset by digital input, and have 3 DO (Digital output).

1. Methods to reset Trip relay is to push the Reset button on the frontal side and to use the remote reset.
  2. Digital input
    - [R11-R22] input: Remote reset
    - [Z1-Z2] input: ZSI input
    - [E1-E2] input: ZCT for earth leakage detection or external CT input
- \*All DI are dry contact that has 3.3V of recognition voltage. When inputting close by SSR (Solid State Relay) or open-collector, connect collector (Drain) to R11.
3. Digital output 3a (524, 534, 544-513)
    - Fault output: Long/Short time delay, Instantaneous, Ground fault, UVR, OVR, UFR, OFR, rPower, Vunbal, lunbal (Maintains state as Latch from until user pushes reset.)
    - General DO: when setting L/R as remote, it is available to control close/open remotely by using communication.



| Trip Relay | Digital Output | Long time | Short time | Instantaneous | Ground | Overload Alarm | OVR | UVR | rPower | Vunbal | lunbal | OFR | UFR | OPR | Note         |
|------------|----------------|-----------|------------|---------------|--------|----------------|-----|-----|--------|--------|--------|-----|-----|-----|--------------|
| P, S type  | DO1 (524)      | ●         | ○          | ○             | ○      | ○              | ○   | ○   | ○      | ○      | ○      | ○   | ○   | ○   | Programmable |
|            | DO2 (534)      | ○         | ●          | ●             | ○      | ○              | ○   | ○   | ○      | ○      | ○      | ○   | ○   | ○   |              |
|            | DO3 (544)      | ○         | ○          | ○             | ●      | ○              | ○   | ○   | ○      | ○      | ○      | ○   | ○   | ○   |              |
| A type     | DO1 (524)      | ●         | x          | x             | x      | Not available  |     |     |        |        |        |     |     |     | Fixed        |
|            | DO2 (534)      | x         | ●          | ●             | x      |                |     |     |        |        |        |     |     |     |              |
|            | DO3 (544)      | x         | x          | x             | ●      |                |     |     |        |        |        |     |     |     |              |

## Communication

### Modbus / RS-485

- Operation mode: Differential
- Distance: Max. 1.2km
- Cable: General RS-485 shielded twist 2-pair cable
- Baud rate: 9,600bps, 19,200bps, 38,400bps
- Transmission method: Half-Duplex
- Termination: 150Ω

### Profibus-DP

- Profibus-DP module is installed separately (Option)
- Operation mode: Differential
- Distance: Max. 1.2km
- Cable: Profibus-DP shielded twist 2-pair cable
- Baud rate: 9,600bps – 12Mbps
- Transmission method: Half-Duplex
- Termination: 150Ω
- Standard: EN 50170/DIN 19245



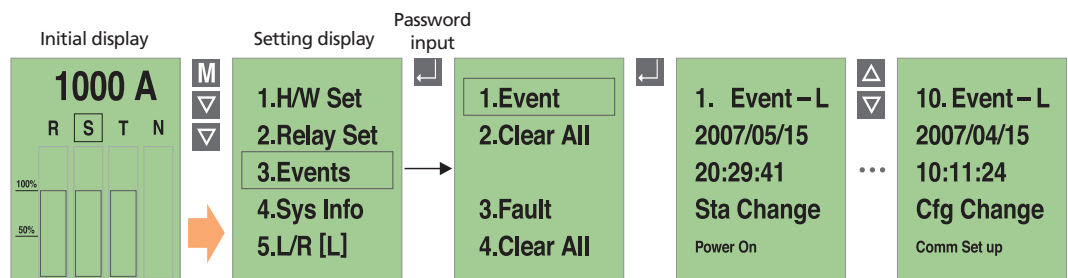
Profibus-DP  
Communication module  
(Option)

# Trip relays

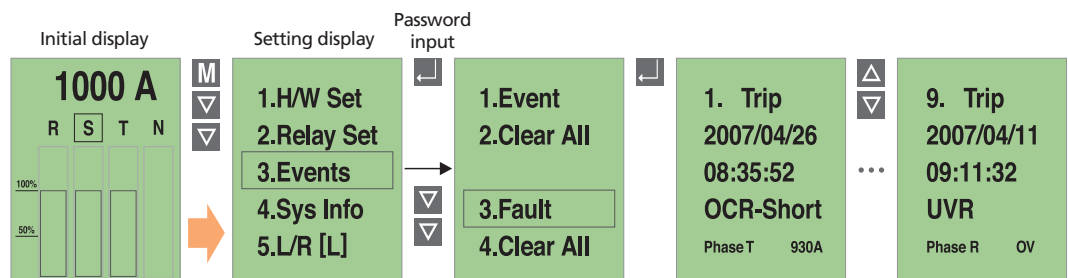
## Event & fault recording (P,S type)

When there are events such as setting change, Info. change, error of self-diagnose, state change, P and S type record Max. up to 256 information of the events in accordance with time (ms). In addition, they can record Max. up to 256 (up to 10 for A type) information of the faults such as fault cause, fault phase, fault value and so on in accordance with time (ms).

### Event information display



### Fault information display

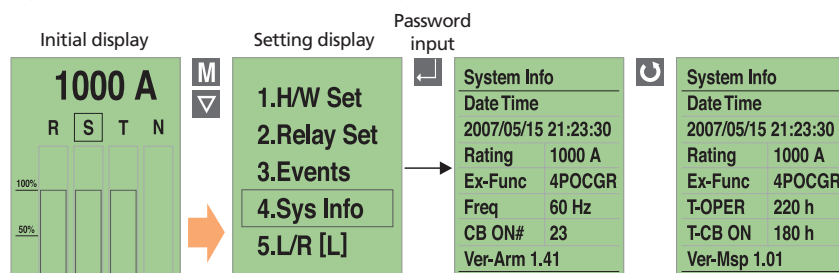


## System information

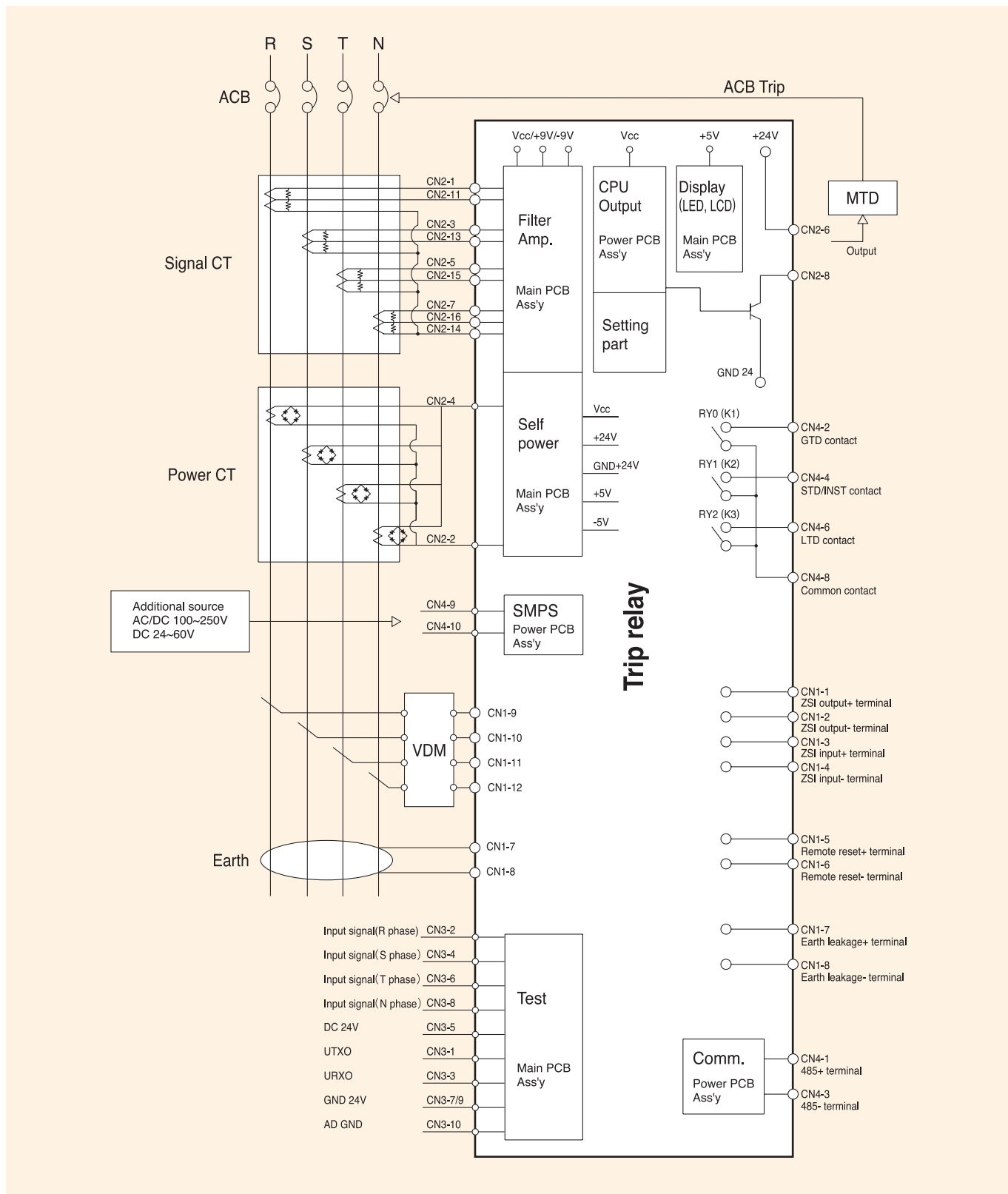
P and S type can indicate information as followings with the information of the ACB.

- Present time: year/month/date/hour/minute/ms
- ACB current ratings
- N-phase current ratings: 100%
- Frequency information: 60Hz/50Hz
- Closing numbers of breaker: CB ON numbers
- Trip relay operating time: OCR ON time
- On time of breaker: CB ON time
- S/W ver. information

### System information display



# System block diagram



# Accessories



| Mounting | Accessories |                                      | AH      |        | AS      |        | AN      |        | Remark | Page |
|----------|-------------|--------------------------------------|---------|--------|---------|--------|---------|--------|--------|------|
|          |             |                                      | Default | Option | Default | Option | Default | Option |        |      |
| Internal | SHT1        | Shunt Coil                           | ●       |        | ●       |        | ●       |        | *      | 50   |
|          | SHT2        | Double Shunt Coil                    |         | ○      |         | ○      |         | ○      | *      | 51   |
|          | CC          | Closing Coil                         | ●       |        | ●       |        | ●       |        | *      | 52   |
|          | M           | Motor                                | ●       |        | ●       |        | ●       |        | *      | 53   |
|          | CS1         | Charge Switch                        | ●       |        | ●       |        | ●       |        | *      | 53   |
|          | CS2         | Charge Switch Communication          |         | ○      |         | ○      |         | ○      | *      | 53   |
|          | UVT         | Under Voltage Trip Device            |         | ○      |         | ○      |         | ○      | *      | 54   |
|          | AL          | Trip Alarm Contact                   |         | ○      |         | ○      |         | ○      | *      | 55   |
|          | MRB         | Manual Reset Button                  |         | ○      |         | ○      |         | ○      | *      | 56   |
|          | RES         | Remote Reset Switch                  |         | ○      |         | ○      |         | ○      | *      | 57   |
|          | RCS         | Ready to Close Switch                |         | ○      |         | ○      |         | ○      | *      | 58   |
|          | C           | Counter                              | ●       |        |         | ○      |         | ○      | *      | 58   |
|          | AX          | Auxiliary Switch                     |         | ○      |         | ○      |         | ○      | *      | 59   |
|          | TM          | Temperature Alarm                    |         | ○      |         | ○      |         | ○      | *      | 76   |
| External | K1          | Key Lock                             |         | ○      |         | ○      |         | ○      | *      | 60   |
|          | K2          | Key Interlock Set                    |         | ○      |         | ○      |         | ○      | *      | 60   |
|          | K3          | Double Key Lock                      |         | ○      |         | ○      |         | ○      | *      | 61   |
|          | B           | On/Off Button Lock                   |         | ○      |         | ○      |         | ○      | *      | 61   |
|          | LH          | Lifting Hook                         |         | ○      |         | ○      |         | ○      |        | 62   |
|          | CTD         | Condenser Trip Device                |         | ○      |         | ○      |         | ○      |        | 62   |
|          | ATS         | Automatic Transfer Switch Controller |         | ○      |         | ○      |         | ○      |        | 63   |
|          | DC          | Dust Cover                           |         | ○      |         | ○      |         | ○      |        | 65   |
|          | OT          | OCR Tester                           |         | ○      |         | ○      |         | ○      |        | 64   |
|          | J           | Manual Connector                     |         | ○      | ●       |        | ●       |        | *      |      |
|          | A           | Automatic Connector                  | ●       |        |         | ○      |         | ○      | *      |      |

\*Seperate purchasing is not allowed. Each item should be purchased with the main body.



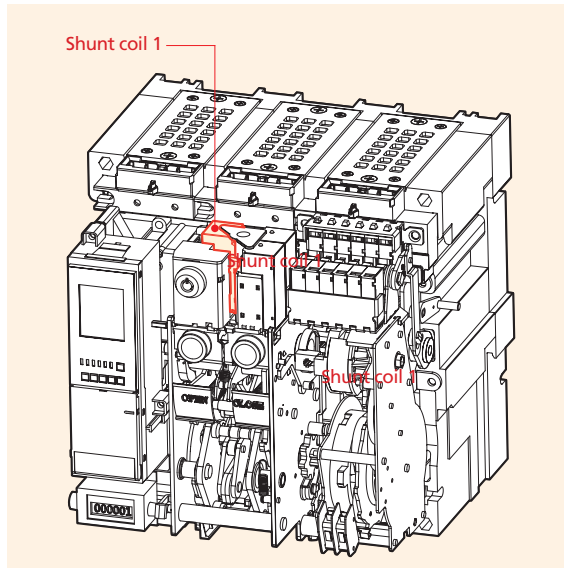
| Mounting   | Accessories |                                 | AH      |        | AS      |        | AN      |        | Remark | Page |
|------------|-------------|---------------------------------|---------|--------|---------|--------|---------|--------|--------|------|
|            |             |                                 | Default | Option | Default | Option | Default | Option |        |      |
| Trip relay | N           | N type                          |         | ○      |         | ○      |         | ○      | *      | 24   |
|            | A           | A type                          |         | ○      |         | ○      |         | ○      | *      | 26   |
|            | P           | P type                          |         | ○      |         | ○      |         | ○      | *      | 28   |
|            | S           | S type                          |         | ○      |         |        |         |        | *      | 30   |
|            | ZCT         | ZCT for the earth leakage       |         | ○      |         | ○      |         | ○      |        |      |
| Cradle     | SBC         | Shorting "b" Contact            |         | ○      |         | ○      |         | ○      |        | 65   |
|            | MI          | Mechanical Interlock            |         | ○      |         | ○      |         | ○      |        | 67   |
|            | ST          | Safety Shutter                  |         | ○      |         | ○      |         | ○      | *      | 68   |
|            | STL         | Safety Shutter Lock             |         | ○      |         | ○      |         | ○      |        | 68   |
|            | DF          | Door Frame                      |         | ○      |         | ○      |         | ○      |        | 69   |
|            | MIP         | Miss Insertion Prevent Device   |         | ○      |         | ○      |         | ○      |        | 74   |
|            | MOC         | Mechanical Operated Cell Switch |         | ○      |         | ○      |         | ○      |        | 67   |
|            | CEL         | Cell Switch                     |         | ○      |         | ○      |         | ○      |        | 70   |
|            | DI          | Door Interlock                  |         | ○      |         | ○      |         | ○      |        | 71   |
|            | ZAS         | Zero Arc Space                  | ●       |        |         | ○      |         |        | *      | 71   |
|            | SC          | Safety Control Cover            | ●       |        | ●       |        | ●       | ○*     | *      | 72   |
|            | CMB         | Cradle Mounting Block           |         | ○      |         | ○      |         | ○      | *      | 72   |
|            | RI          | Racking Interlock               |         | ○      |         | ○      |         | ○      |        | 73   |
|            | PL          | Pad lock / Positon Lock         | ●       |        | ●       |        | ●       |        | *      | 73   |
|            | IB          | Insulation Barrier              | ●       |        |         | ○      |         | ○      | *      | 69   |
|            | UDC         | UVT Time Delay Controller       |         | ○      |         | ○      |         | ○      |        | 75   |
|            | ADP         | Compatible Adapter              |         | ○      |         | ○      |         | ○      |        |      |
| Other      | RPH         | Reverse Phase ACB               |         | ○      |         | ○      |         | ○      |        |      |
|            | DUM         | Dummy ACB                       |         | ○      |         | ○      |         | ○      |        |      |
|            | VAD         | Various Connection Type         |         | ○      |         | ○      |         | ○      |        |      |
|            | RCO         | Remote I/O                      |         | ○      | ●       |        | ●       |        |        | 77   |
|            | PC          | Profibus-DP comm. module        | ●       |        |         | ○      |         | ○      |        |      |

\*Seperate purchasing is not allowed. Each item should be purchased with the main body.

\* It is available only when the control block is in the mode of auto-connection.

# Accessories

## Shunt Coil [SHT1]

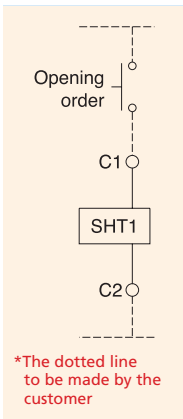


- SHT1 is a control device which trips a circuit breaker from remote place, when applying voltage continuously or instantaneously over 200ms to coil terminals (C1, C2).
- When UVT coil is installed, its location is changed.

### 1. Rated voltage and characteristics of Trip coil

| Rated voltage [Vn] |           | Operating voltage range [V] | Power consumption (VA or W) |              | Trip time [ms] |
|--------------------|-----------|-----------------------------|-----------------------------|--------------|----------------|
| DC [V]             | AC [V]    |                             | Inrush                      | Steady-state |                |
| 24 – 30            | -         | 0.6 – 1.1 Vn                | 200                         | 5            | Less than 40ms |
| 48 – 60            | 48        | 0.6 – 1.1 Vn                |                             |              |                |
| 100 – 130          | 100 – 130 | 0.56 – 1.1 Vn               |                             |              |                |
| 200 – 250          | 200 – 250 | 0.56 – 1.1 Vn               |                             |              |                |
| -                  | 380 – 480 | 0.56 – 1.1 Vn               |                             |              |                |

Note) Operating voltage range is the min. rated voltage standard for each rated voltage (Vn).



\*The dotted line to be made by the customer

Wiring Diagram

### 2. Specification of the wire

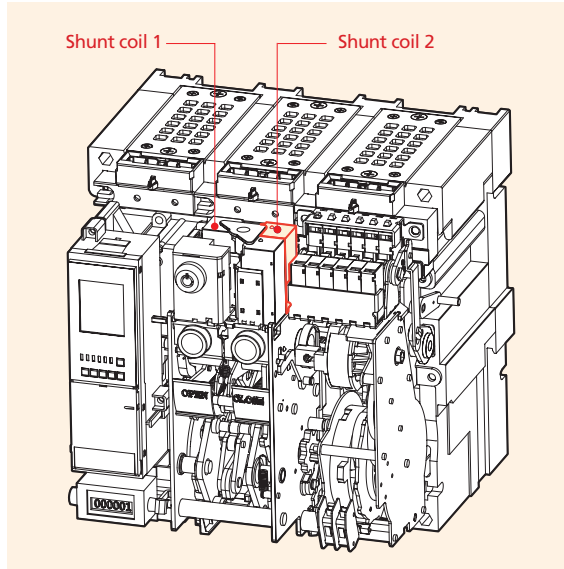
- Refer to the below table regarding the length and specification of wire when using trip coil with DC 24 – 30 [V] or DC/AC 48 – 60 [V] of rated voltage.

The maximum wire length

|                   |      | Rated voltage [Vn]             |                                |                                |                                |
|-------------------|------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
|                   |      | DC 24 – 30 [V]                 |                                | DC/AC 48 [V]                   |                                |
| Wire type         |      | #14 AWG (2.08mm <sup>2</sup> ) | #16 AWG (1.31mm <sup>2</sup> ) | #14 AWG (2.08mm <sup>2</sup> ) | #16 AWG (1.31mm <sup>2</sup> ) |
| Operating voltage | 100% | 95.7m                          | 61m                            | 457.8m                         | 287.7m                         |
|                   | 85%  | 62.5m                          | 38.4m                          | 291.7m                         | 183.2m                         |



## Double Shunt Coil [SHT2]

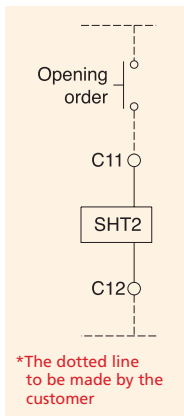


- SHT2 is a control device which trips a circuit breaker doubly from the outside. When SHT1 doesn't operate normally, it can trip a circuit breaker safely.
- Shunt coil 1: Install it at existing location.
- Shunt coil 2: Install it on the right side of the Shunt coil 1
- It is not available with UVT coil when installing couple shunt coil.

### 1. Rated voltage and characteristics of Trip coil

| Rated voltage [Vn] |           | Operating voltage range [V] | Power consumption (VA or W) |              | Trip time [ms] |
|--------------------|-----------|-----------------------------|-----------------------------|--------------|----------------|
| DC [V]             | AC [V]    |                             | Inrush                      | Steady-state |                |
| 24 – 30            | -         | 0.6 – 1.1 Vn                | 200                         | 5            | Less than 40ms |
| 48 – 60            | 48        | 0.6 – 1.1 Vn                |                             |              |                |
| 100 – 130          | 100 – 130 | 0.56 – 1.1 Vn               |                             |              |                |
| 200 – 250          | 200 – 250 | 0.56 – 1.1 Vn               |                             |              |                |
| -                  | 380 – 480 | 0.56 – 1.1 Vn               |                             |              |                |

Note) Operating voltage range is the min. rated voltage standard for each rated voltage (Vn).



Wiring Diagram

### 2. Specification of the wire

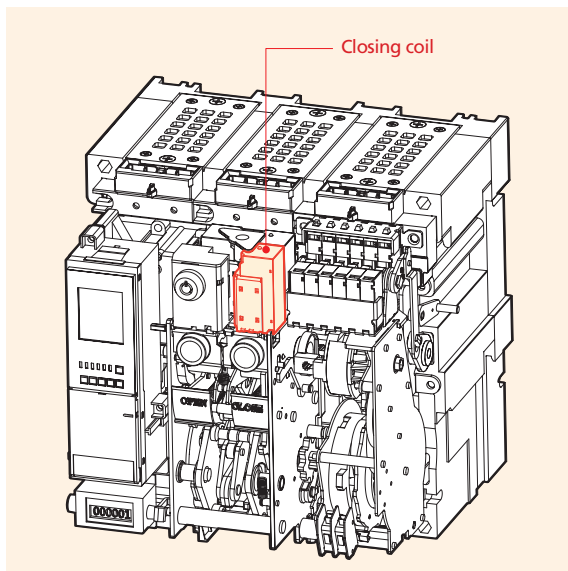
- Refer to the below table regarding the length and specification of wire when using trip coil with DC 24 – 30 [V] or DC/AC 48 – 60 [V] of rated voltage.

The maximum wire length

|                   |      | Rated voltage [Vn]             |                                |                                |                                |
|-------------------|------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
|                   |      | DC 24 – 30 [V]                 |                                | DC/AC 48 [V]                   |                                |
| Wire type         |      | #14 AWG (2.08mm <sup>2</sup> ) | #16 AWG (1.31mm <sup>2</sup> ) | #14 AWG (2.08mm <sup>2</sup> ) | #16 AWG (1.31mm <sup>2</sup> ) |
| Operating voltage | 100% | 95.7m                          | 61m                            | 457.8m                         | 287.7m                         |
|                   | 85%  | 62.5m                          | 38.4m                          | 291.7m                         | 183.2m                         |

# Accessories

## Closing Coil [CC]

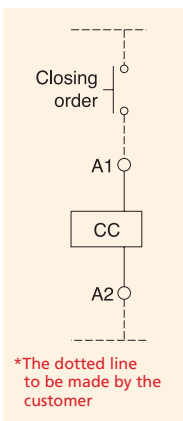


- It is a control device which close a circuit breaker, when the voltage is applied continuously or instantaneously over 200ms to the coil terminals (C1, C2).

### 1. Rated voltage and characteristics of Closing coil

| Rated voltage [Vn] |           | Operating voltage range [V] | Power consumption (VA or W) |              | Trip time [ms] |
|--------------------|-----------|-----------------------------|-----------------------------|--------------|----------------|
| DC [V]             | AC [V]    |                             | Inrush                      | Steady-state |                |
| 24 – 30            | -         | 0.75 – 1.1 Vn               | 200                         | 5            | Less than 80ms |
| 48 – 60            | 48        | 0.75 – 1.1 Vn               |                             |              |                |
| 100 – 130          | 100 – 130 | 0.75 – 1.1 Vn               |                             |              |                |
| 200 – 250          | 200 – 250 | 0.75 – 1.1 Vn               |                             |              |                |
| -                  | 380 – 480 | 0.75 – 1.1 Vn               |                             |              |                |

Note) Operating voltage range is the min. rated voltage standard for each rated voltage (Vn).



Wiring Diagram

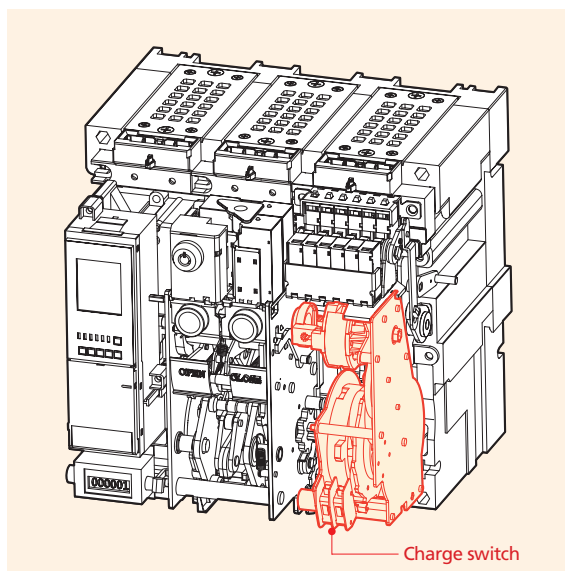
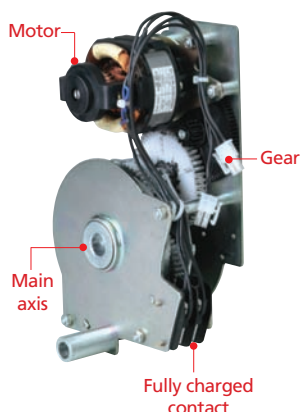
### 2. Specification of the wire

- Refer to the below table regarding the length and specification of wire when using trip coil with DC 24 – 30 [V] or DC/AC 48 – 60 [V] of rated voltage.

The maximum wire length

|                   |      | Rated voltage [Vn]             |                                |                                |                                |
|-------------------|------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
|                   |      | DC 24 – 30 [V]                 |                                | DC/AC 48 [V]                   |                                |
| Wire type         |      | #14 AWG (2.08mm <sup>2</sup> ) | #16 AWG (1.31mm <sup>2</sup> ) | #14 AWG (2.08mm <sup>2</sup> ) | #16 AWG (1.31mm <sup>2</sup> ) |
| Operating voltage | 100% | 95.7m                          | 61m                            | 457.8m                         | 287.7m                         |
|                   | 85%  | 62.5m                          | 38.4m                          | 291.7m                         | 183.2m                         |

## Motor [M]



- Charge the closing spring of a circuit breaker by the external power source. Without the external power source, charge manually.
- Operating voltage range (IEC 60947) 85% – 110% Vn

| Input voltage (V)       | DC 24 – 30V                                 | AC/DC 48 – 60V | AC/DC 100 – 130V | AC/DC 200 – 250V | AC 380V | AC440 – 480V |
|-------------------------|---|----------------|------------------|------------------|---------|--------------|
| Load current (max.)     | 5A  | 3A             | 1A               | 0.5A             | 0.3A    | 0.3A         |
| Starting current (max.) | 5 times of load current                     |                |                  |                  |         |              |
| Load rpm (Motor)        | 15,000 – 19,000 rpm                         |                |                  |                  |         |              |
| Charge time             | Less than 5 sec.                            |                |                  |                  |         |              |
| Dielectric strength     | 2kV/min                                     |                |                  |                  |         |              |
| Using temperature range | -20° – 60°                                  |                |                  |                  |         |              |
| Using humidity range    | Max. RH 80% (No dew condensation)           |                |                  |                  |         |              |
| Endurance               | 15,000 cycle (Load connection, 2 times/min) |                |                  |                  |         |              |
| Charge switch           | 10A at 250VAC                               |                |                  |                  |         |              |

## Charge Switch [CS1]

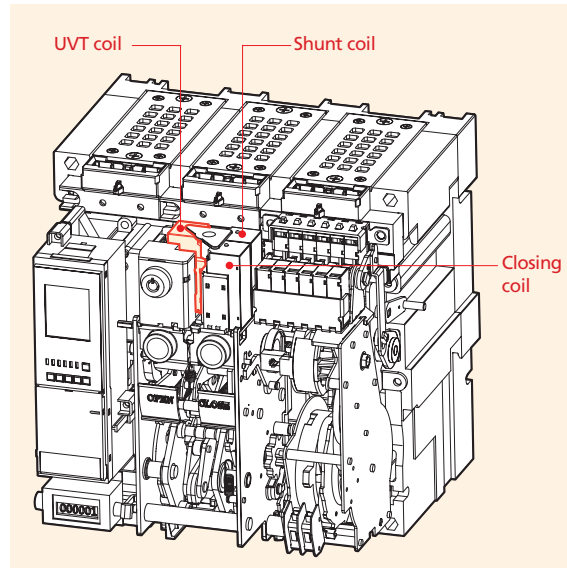
## Charge Switch Communication [CS2]

- It is a built-in contact which sends the signal to the outside, when motor charging is completed. (2a)
- It has a “1a” contact for communication and the other “1a” contact for complete charging.
- When using an extra communication module (Reote I/O), the state of contacts can be displayed through the network.
- 10A at 250VAC

\*Charge Switch Communication [CS2] is optional only at AKS type.

# Accessories

## Under Voltage Trip device [UVT]



- If the voltage of the main or the control power is under voltage, UVT which is installed inside of the breaker breaks the circuit automatically. Please connect with UVT time-delay device in order to present the time-delay function because UVT is technically instantaneous type.
- The closing of a circuit breaker is impossible mechanically or electrically if control power not supplied to UVT. To close the circuit breaker, 65 – 85% of rated voltage should be applied to both terminals of UVT coil (D1, D2).
- When using UVT coil, the double trip coil can not be used, and the location of trip coil is changed.

### 1. Rated voltage and characteristics of UVT coil

| Rated voltage [Vn] |           | Operating voltage range [V] |              | Power consumption (VA or W) |              | Trip time [ms] |
|--------------------|-----------|-----------------------------|--------------|-----------------------------|--------------|----------------|
| DC [V]             | AC [V]    | Pick up                     | Drop out     | Inrush                      | Steady-state |                |
| 24 – 30            | -         | 0.65 – 0.85 Vn              | 0.4 – 0.6 Vn | 200                         | 5            | Less than 50ms |
| 48 – 60            | 48        |                             |              |                             |              |                |
| 100 – 130          | 100 – 130 |                             |              |                             |              |                |
| 200 – 250          | 200 – 250 |                             |              |                             |              |                |
| -                  | 380 – 480 |                             |              |                             |              |                |

Note) Operating voltage range is the min. rated voltage standard for each rated voltage (Vn).

### 2. Specification of the wire

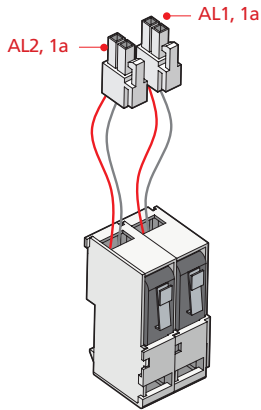
- Refer to the below table regarding the length and specification of wire when using trip coil with DC 24 – 30 [V] or DC/AC 48 – 60 [V] of rated voltage.

The maximum wire length

|                   |      | Rated voltage [Vn]             |                                |                                |                                |
|-------------------|------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
|                   |      | DC 24 – 30 [V]                 |                                | DC/AC 48 [V]                   |                                |
| Wire type         |      | #14 AWG (2.08mm <sup>2</sup> ) | #16 AWG (1.31mm <sup>2</sup> ) | #14 AWG (2.08mm <sup>2</sup> ) | #16 AWG (1.31mm <sup>2</sup> ) |
| Operating voltage | 100% | 48.5m                          | 30.5m                          | 233.2m                         | 143.9m                         |
|                   | 85%  | 13.4m                          | 8.8m                           | 62.5m                          | 39.3m                          |

Note) In case of using UVT coil, the location of TC coil is changed.

## Trip Alarm Contact [AL]



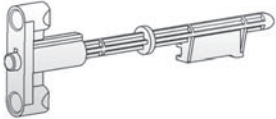
- When a circuit breaker is tripped by OCR which operates against the faulty current (Over Current Relay), Trip Alarm switch provides the information regarding the trip of circuit breaker by sending the electrical signal from the mechanical indicator on main cover of main circuit breaker or internal auxiliary switch. (Installed at the inside of circuit breaker)
- When a circuit breaker tripped by faulty current, a mechanical trip indicator (MRB, Manual Reset Button) pops out fro the main cover and the switch (AL) which sends control signal electrically is conducted to output the information occurred from faulty circuit breaker.
- MRB and AL can be operated only when tripping by OCR, but doesn't be operated by Off button and OFF operation of trip coil.
- To re-close a circuit breaker after a trip, press MRB to reset it for closing.
- 2 pcs of electrical trip switch (AL1, AL2, 1a) are provided (Option)
- Trip alarm contact and MRB (Manual reset button) need to be purchased together.

### 1. Electrical characteristics of trip alarm contact

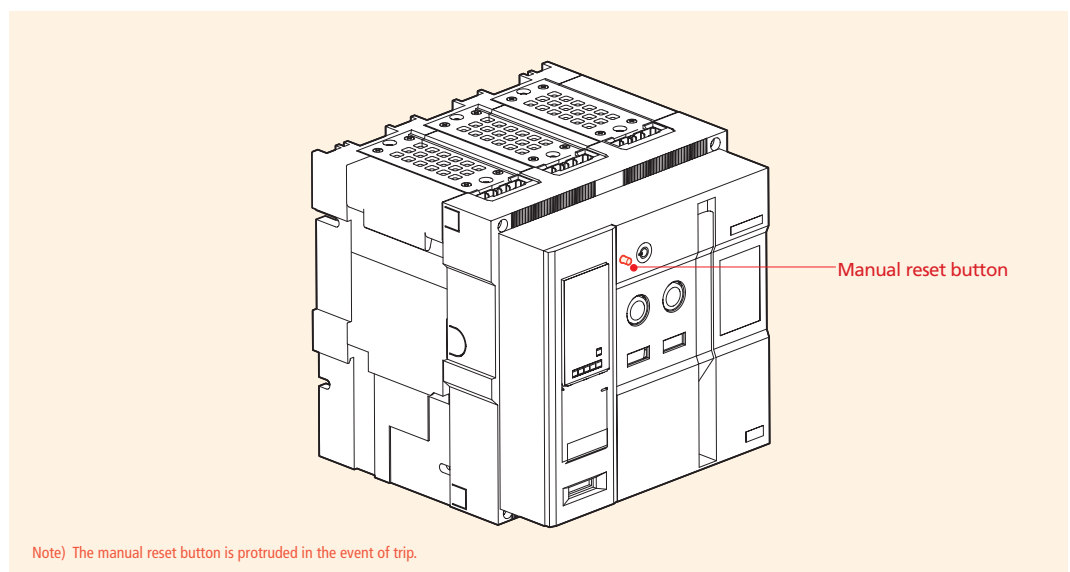
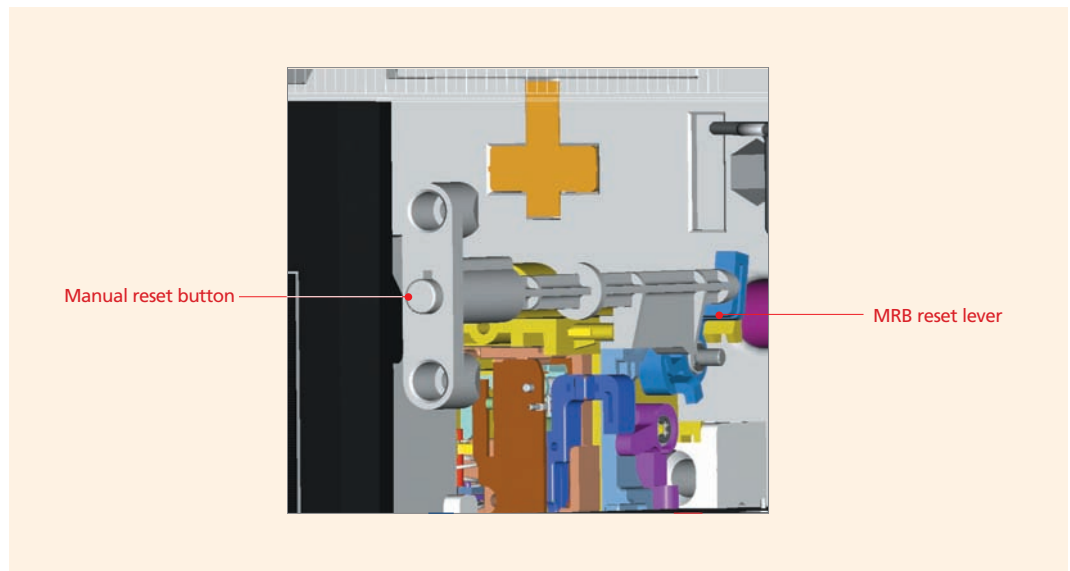
| Rated voltage (V) | Non-inductive load (A) |           | Inductive load (A) |            | Inrush current |
|-------------------|------------------------|-----------|--------------------|------------|----------------|
|                   | Resistive load         | lamp load | Inductive load (A) | Motor load |                |
| 8V DC             | 11                     | 3         | 6                  | 3          | Max. 24A       |
| 30V DC            | 10                     | 3         | 6                  | 3          |                |
| 125V DC           | 0.6                    | 0.1       | 0.6                | 0.1        |                |
| 250V DC           | 0.3                    | 0.05      | 0.3                | 0.05       |                |
| 250V AC           | 11                     | 1.5       | 6                  | 2          |                |

# Accessories

## Manual Reset Button [MRB]



- It is a function which resets a circuit breaker manually when a circuit breaker is tripped by OCR.
- When a circuit breaker tripped by faulty current, a mechanical trip indicator (MRB, Manual Reset Button) pops out fro the main cover and the switch (SDE) which sends control signal electrically is conducted to output the information occurred from faulty circuit breaker.
- MRB can be operated only by OCT but not by OFF operation of circuit breaker. To re-close a circuit breaker after a trip, press MRB to reset it for closing.

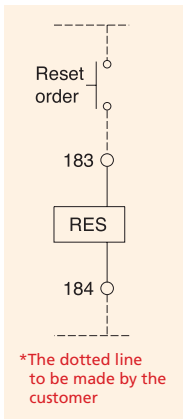


## Remote Reset Switch [RES]

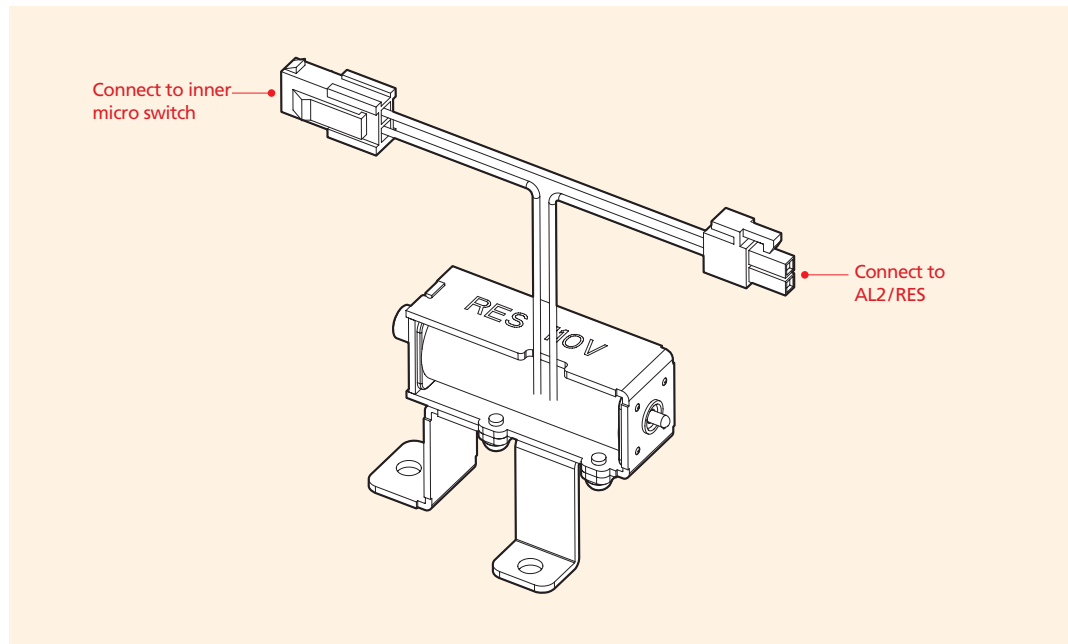
- Following tripping, this function resets the “fault trip” alarm contacts (AL) and the mechanical indicator (MRB) and enables circuit breaker closing.  
Push button switch: AC125V 10A, AC 250V 6A, DC 110V 2.2A, DC 220V 1.1A Resistive load
- In case of auto reset type circuit breaker  
Following tripping, a reset of Manual Reset Button (MRB) or Remote Reset Switch (RES) is no longer required to enable circuit breaker closing.  
The mechanical indicator (MRB) and electrical indicator (AL) remain in fault position until reset button is pressed.
- AL2 and RES are alternative

### 1. Rated voltage and rated current of RES

| Rated voltage    | Operating current (Max.) |      | Operating time                 | Wire spec. |                                 |
|------------------|--------------------------|------|--------------------------------|------------|---------------------------------|
| AC/DC 100 – 130V | AC                       | 6A   |                                | Less 40ms  | #14 AWG (2.08 mm <sup>2</sup> ) |
|                  | DC                       | 5A   | #16 AWG (1.31mm <sup>2</sup> ) |            |                                 |
| AC/DC 200 – 250V | AC                       | 3A   |                                |            |                                 |
|                  | DC                       | 2.5A |                                |            |                                 |

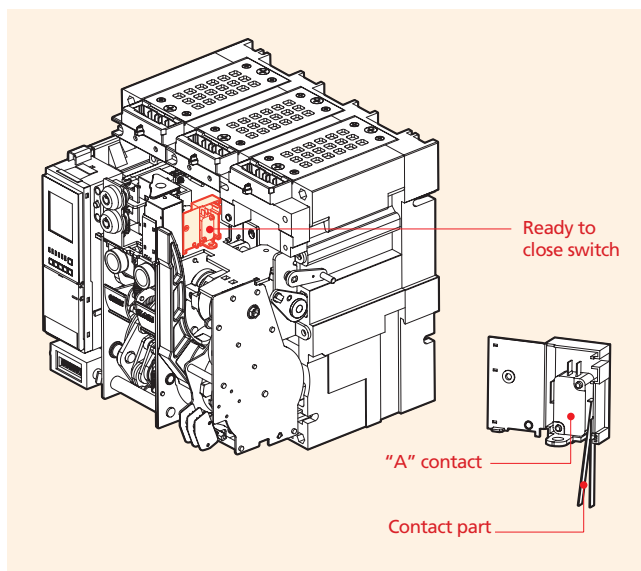


Wiring Diagram



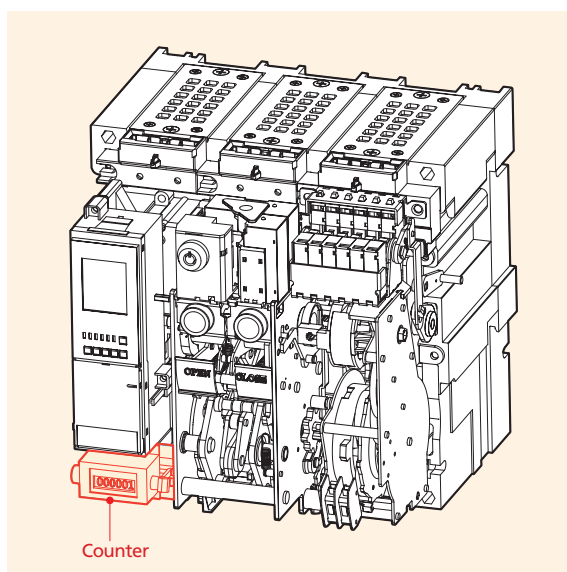
# Accessories

## Ready to Close Switch [RCS]



- It interlocks with mechanism of circuit breaker.
- It indicates the status that the circuit breaker is ready to do closing operation.
- When mechanism is in OFF position or in Charge, contact is output with "ON" and it indicates that mechanism can be closed.

## Counter [C]



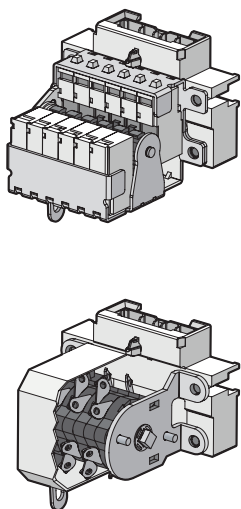
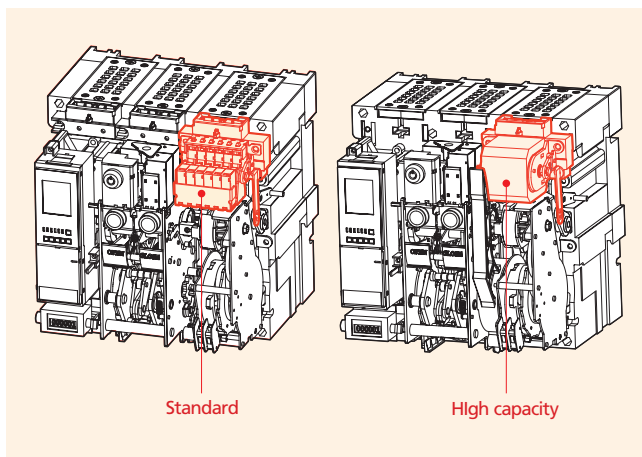
- It displays the total number of ON/OFF operation of ACB.



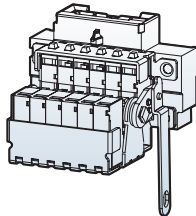
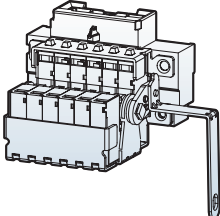
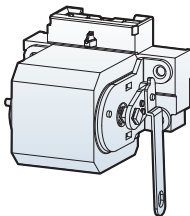
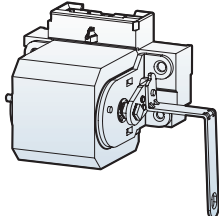
## Auxiliary switch [AX]

- It is a contact used to monitor ON/OFF position of ACB from remote place.

| AUX. contact & charging types |                               |
|-------------------------------|-------------------------------|
| AX                            | Standard OFF charge 3a3b      |
| AC                            | Standard ON charge 3a3b       |
| BX                            | Standard OFF charge 5a5b      |
| BC                            | Standard ON charge 5a5b       |
| HX                            | High capacity OFF charge 5a5b |
| HC                            | High capacity ON charge 5a5b  |
| CC                            | Standard ON charge 6a6b       |
| JC                            | High capacity ON charge 6a6b  |



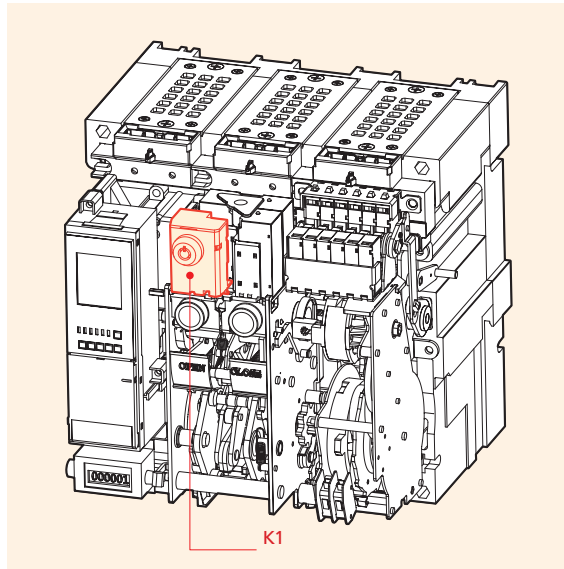
## Standard classification

| Standard  |   | High capacity  |   |
|---|---|--|---|
| 2000, 5000AF  | 4000, 6300AF  | 2000, 5000AF   | 4000, 6300AF  |
|  |  |  |  |

| Classification                  |    |      | Standard       |                | High capacity  |                | Remark                             |
|---------------------------------|----|------|----------------|----------------|----------------|----------------|------------------------------------|
|                                 |    |      | Resistive load | Inductive load | Resistive load | Inductive load |                                    |
| Contact capacity                | AC | 490V | 5A             | 6A             | 5A             | 2.5A           |                                    |
|                                 |    | 250V | 10A            | 6A             | 10A            | 10A            |                                    |
|                                 |    | 125V | 10A            | 6A             | 10A            | 10A            |                                    |
|                                 | DC | 250V | 0.3A           | 0.3A           | 3A             | 1.5A           |                                    |
|                                 |    | 125V | 0.5A           | 0.6A           | 10A            | 6A             |                                    |
| No. of Contact that can be used |    | 30V  | 10A            | 6A             | 10A            | 10A            |                                    |
|                                 |    | AX   | 3a3b           |                | -              |                | Standard charging type             |
|                                 |    | BX   | 5a5b           |                | -              |                |                                    |
|                                 |    | HX   | -              |                | 5a5b           |                |                                    |
|                                 |    | AC   | 3a3b           |                | -              |                | Rapid auto-reclosing charging type |
|                                 |    | BC   | 5a5b           |                | -              |                |                                    |
|                                 |    | CC   | 6a6b           |                | -              |                |                                    |
|                                 | HC | -    |                | 5a5b           |                |                |                                    |
|                                 | JC | -    |                | 6a6b           |                |                |                                    |

# Accessories

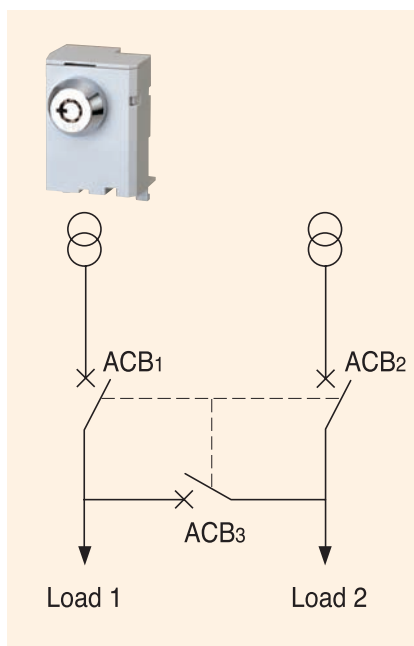
## Key Lock [K1]



- It is a device for locking which prevents a certain circuit breaker from being operated by user's discretion when two or more circuit breakers are used at the same time.
- K1: Preventing mechanical closing

## Key Interlock Set [K2]

### Wiring

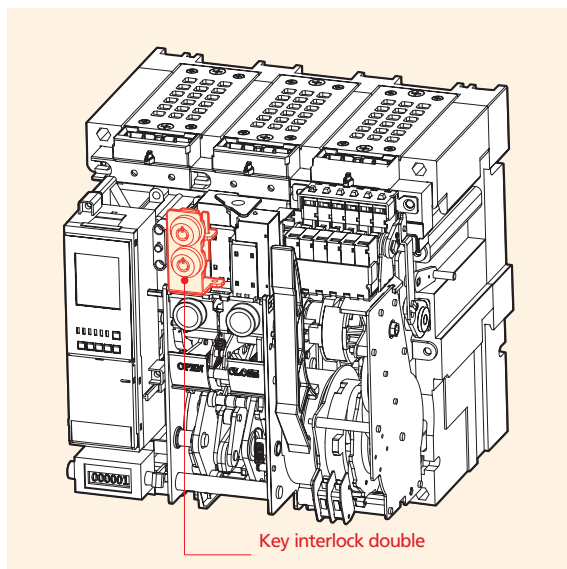


- 3 circuit breakers can be arranged for the continuous power supply to the load side and be interlocked mutually by using Key Lock embedded in each circuit breaker.

| ACB-1 | ACB-2 | ACB-3 | Status |       |
|-------|-------|-------|--------|-------|
|       |       |       | LOAD1  | LOAD2 |
| ●     | ●     | ●     | OFF    | OFF   |
| ●     | ○     | ○     | OFF    | ON    |
| ○     | ●     | ○     | ON     | OFF   |
| ○     | ○     | ●     | ON     | ON    |
| ●     | ●     | ○     | OFF    | OFF   |
| ●     | ○     | ●     | OFF    | ON    |
| ○     | ●     | ●     | ON     | OFF   |

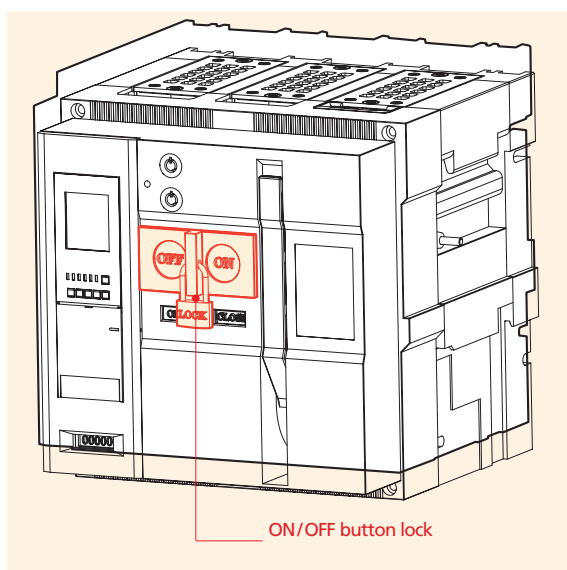
○ : Release    ● : Lock

## Double Key Lock [K3]



- When only two keys are released at the same time, circuit breakers operate. Handling method is same as K1.

## ON/OFF Button Lock [B]

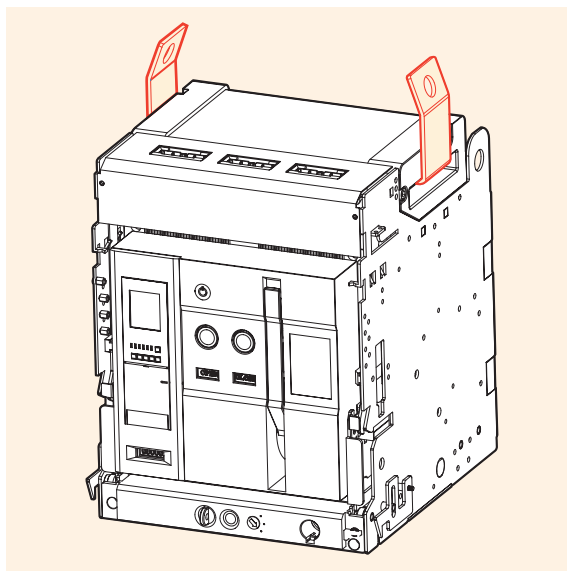


- It is to prevent manual operation of ACB's closing/tripping button due to user's wrong handling.
- It is not possible to handle ON/OFF operation under the "Button lock" status.

Note) Padlocks (05 – 06) are not supplied.

# Accessories

## Lifting Hook [LH]



- It is a device to make an ACB easy to shift.
- Please hang it to both handles of the arc cover.

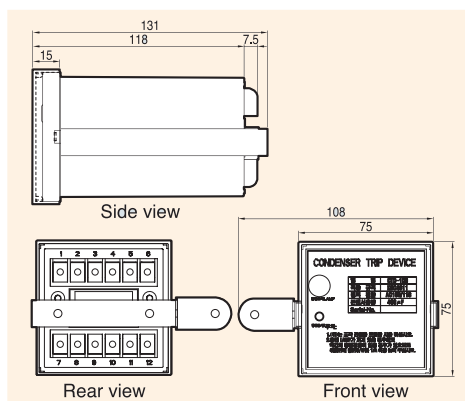
## Condenser Trip Device [CTD]

- It gets a circuit breaker tripped electrically with regular time when control power supply is broken down and is used with Shunt coil, SHT. In case there is no DC power, It can be used as the rectifier which supplies DC power to a circuit breaker by rectifying AC power.

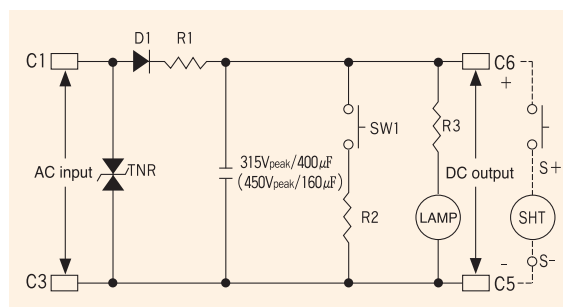
### Ratings

| Ratings                    | Specification |             |
|----------------------------|---------------|-------------|
| Model                      | CTD-100       | CTD-200     |
| Rated input voltage (V)    | AC 100/110    | AC200/220   |
| Frequency (Hz)             | 50/60         | 50/60       |
| Rated charge voltage (V)   | 140/155       | 280/310     |
| Charging time              | Within 5S     | Within 5S   |
| Trip possible time         | Over 3 MIN    | Over 2 MIN  |
| Range of Input voltage (%) | 85 – 110      | 85 – 111    |
| Condenser capacity         | 400 $\mu$ F   | 160 $\mu$ F |

### External dimension

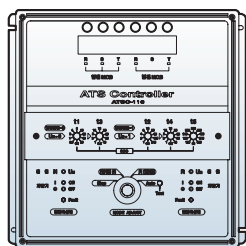


### Circuit diagram



## Automatic Transfer Switch Controller [ATS]

### Ratings

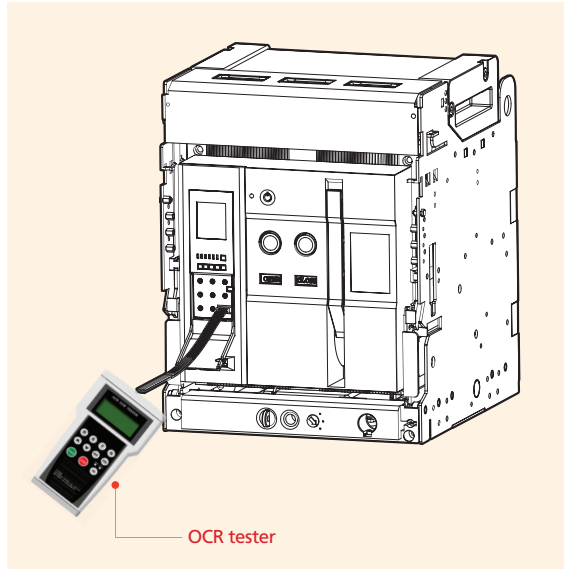


| Model Type                                       | ATSC-110                     | ATSC-110-C | ATSC-220                  | ATSC-220-C |
|--|------------------------------|------------|---------------------------|------------|
| Rated voltage                                    | AC 110V                      |            | AC 220V                   |            |
| Voltage range                                    | AC 93.5 (±5%) – 126.5V (±5%) |            | AC 187 (±5%) – 253V (±5%) |            |
| Frequency  | 50Hz/60Hz                    |            |                           |            |
| Power consumption (apparent power)               | 15.4W                        |            |                           |            |
| 4-location switch (stop, N, R, Auto)             | ■                            | ■          | ■                         | ■          |
| Test function                                    | ■                            | ■          | ■                         | ■          |
| Generator control function                       | ■                            | ■          | ■                         | ■          |
| NRS function                                     | ■                            | ■          | ■                         | ■          |
| N power source setting (phase-to-phase/3 phases) | ■                            | ■          | ■                         | ■          |
| Time setting (T1 – T6)                           | ■                            | ■          | ■                         | ■          |
| Fault function (OCR/Circuit breaker trouble)     | ■                            | ■          | ■                         | ■          |
| Output contact (Auto, Load burden)               | ■                            | ■          | ■                         | ■          |
| Communication function (RS-485)                  | -                            | ■          | -                         | ■          |

- T<sub>1</sub>: The delayed time from when UN (power supply or electric company) is tripped to when generator start-up signal contact is closed. (t<sub>1</sub>: 0.1, 0.5, 1, 2, 4, 8, 15, 30, 40, 50secs)
- T<sub>2</sub>: The delayed time from when UN is closed to when ACB<sub>2</sub> is tripped. (t<sub>2</sub>: 0.1, 1, 2, 4, 8, 15, 30, 60, 120, 240secs)
- T<sub>3</sub>: The delayed time from when ACB<sub>1</sub> is tripped to when ACB<sub>2</sub> is closed. (t<sub>3</sub>: 0.5, 1, 2, 5, 10, 15, 20, 25, 30, 40secs)
- T<sub>4</sub>: The delayed time from when ACB<sub>2</sub> is tripped to when ACB<sub>1</sub> is closed. (t<sub>4</sub>: 0.5, 1, 2, 5, 10, 15, 20, 25, 30, 40secs)
- T<sub>5</sub>: The delayed time when ACB<sub>1</sub> is closed to when generator start-up signal contact is opened. (t<sub>5</sub>: 60, 120, 180, 240, 300, 360, 420, 480, 540, 600secs)
- Stop-mode: This mode is for compulsory closing of ACB<sub>1</sub> (electric power company) or ACB<sub>2</sub> (power station) when UN (power supply of electric power company) or UR (power supply of power station) is available  
\*UN or UR should be kept in ON position
- N-mode: This mode is for compulsory closing of ACB<sub>1</sub> when UN is available.  
\*it does not matter to be ON or OFF position of UR and if converting to N-mode while using UR, generator start-up signal contact is opened.
- R-mode: This mode is for compulsory closing of ACB<sub>2</sub> during the use of UR regardless of that UN is available or not.
- Auto-mode: This mode is for transferring a circuit breaker automatically to available power supply of UN or UR. In short, it trips the circuit breaker where power supply is not available and it close to the circuit breaker where supply is available.

# Accessories

## OCR Tester [OT]



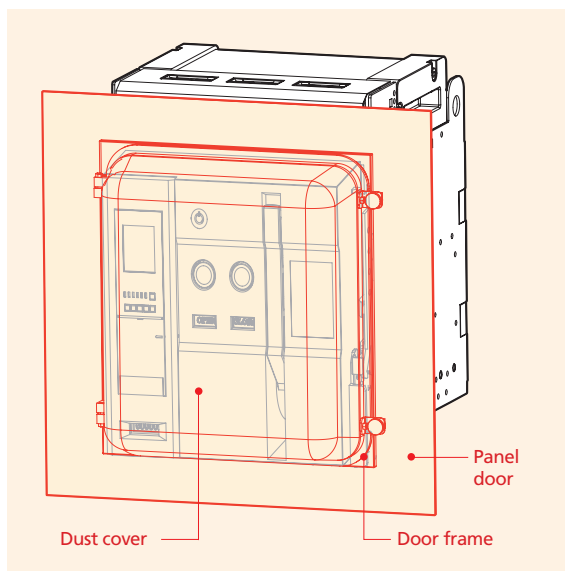
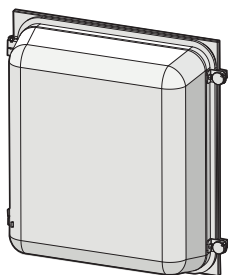
- It is a device which can test for the operation of Trip Relay under no power condition.
1. Maximum 17 times rated current can be inputted.
  2. It is possible to enter the current value and phase on each of R/S/T/N.
  3. Frequency is adjustable.
  4. It is available to test for long time delay/short time delay/instantaneous/ground fault.

## Configuration



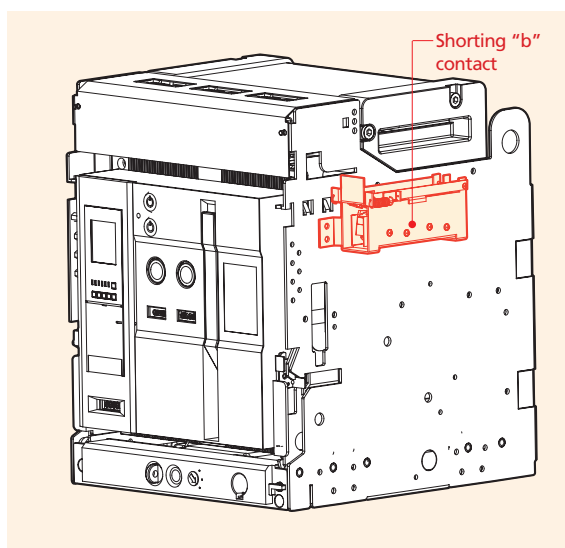
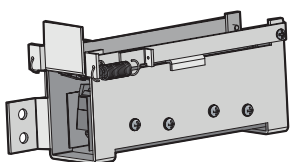
|                 |                                |
|-----------------|--------------------------------|
| R S T N         | R, S, T, N phase signal input  |
| ⤴ ⤵             | Increase/Decrease signal input |
| ENT. ESC        | Signal setting/Delete          |
| START STOP      | Waveform generation/Stop       |
| 50Hz 60Hz<br>Hz | Select frequency               |

## Dust Cover [DC]



- Attach it to the door frame.
- It protects the product against the dust (IP5X) which may cause faulty operation and enhances the sealing degree by being mounted to protrude type of panel.
- It is transparent so that the front side of ACB is visible and the Cover can be opened/closed even if ACB is drawn out to unit TEST position.

## Shorting "b" Contact [SBC]



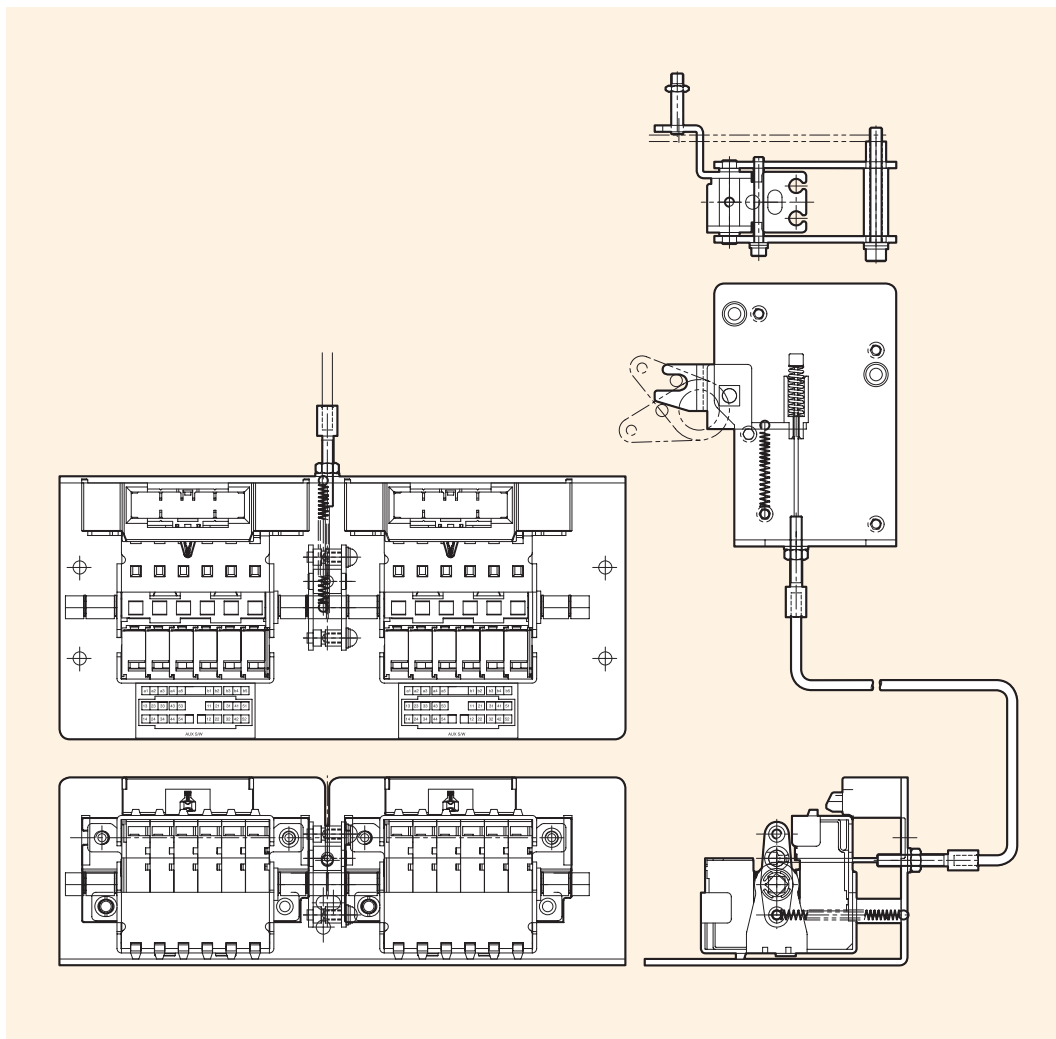
- It is the contact which keeps the external control circuit in normal by Aux. contact which disconnects "Axb" when ACB is moved from CONNECTED position to TEST position. The number of "shorting b-contact" corresponds to the number of "Axb" (4b).

## Contact condition (Link between Axb and shorting "b" contact)

| ACB location            |                    | ACB condition |      |
|-------------------------|--------------------|---------------|------|
|                         |                    | CLOSE         | OPEN |
| Shorting "b" contact    | CONNECTED location | OFF           | OFF  |
|                         | TEST location      | ON            | ON   |
| Auxiliary contact (Axb) | CONNECTED location | OFF           | ON   |
|                         | TEST location      | OFF           | ON   |

# Accessories

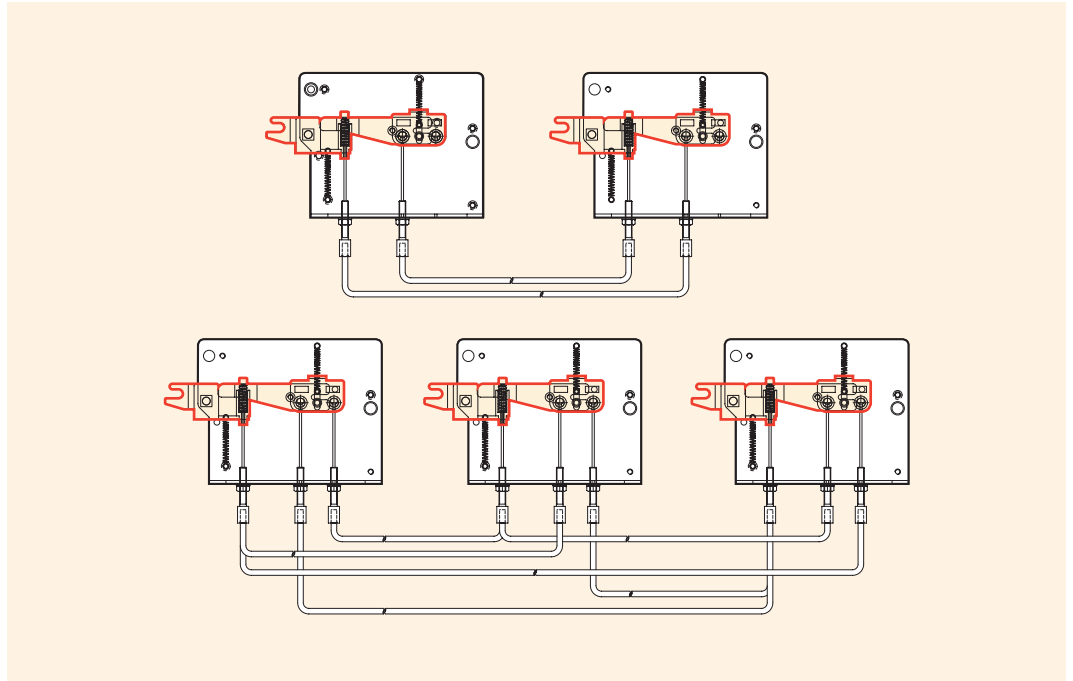
## Mechanical Operated Cell Switch [MOC]



- It is the contact (10a10b) which displays the ON/OFF condition of ACB.  
It mechanically operates only when the breaker is "CONNECTED" position.  
A standard type and a high capacity type is available.
- The contact capacity is as same as the ratings of aux. contacts.
- When MOC link is installed to cradel, MOC can be equipped with the inside of panel.



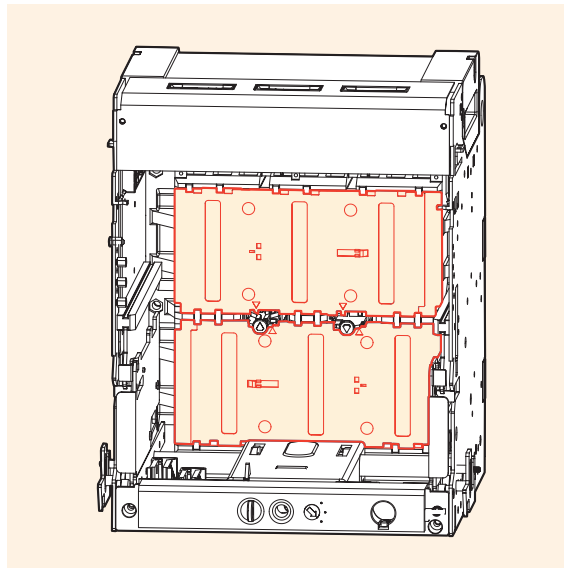
## Mechanical Interlock [MI]



- It is used to interlock closing and trip between two or three breakers mechanically so as to prevent unintended operation at the same time.
- Wire type interlock can be applied upto 3 breakers

# Accessories

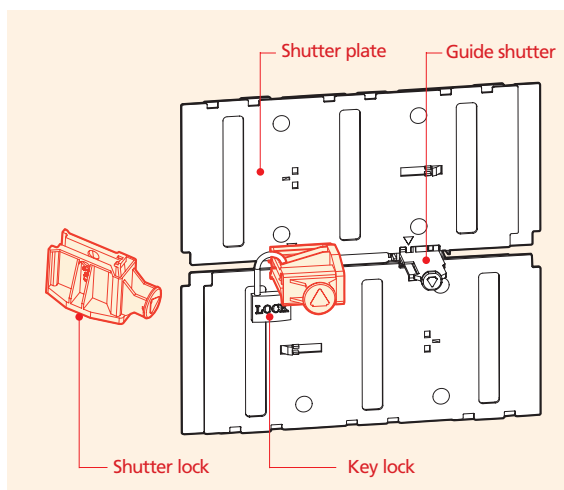
## Safety Shutter [ST]



- It is the automatic safety device to protect the connectors of main circuit by cutting off dangerous contact from outside while the breaker is drawn out. When the ACB is drawn in, the shutter is automatically opened.
- There are 4 types of Safety Shutter and they are divided as shown in figure below.

| The types of safety shutter plate |                 |
|-----------------------------------|-----------------|
| 2000/5000AF, 3P                   | 4000/6300AF, 3P |
|                                   |                 |
| 2000/5000AF, 4P                   | 4000/6300AF, 3P |
|                                   |                 |

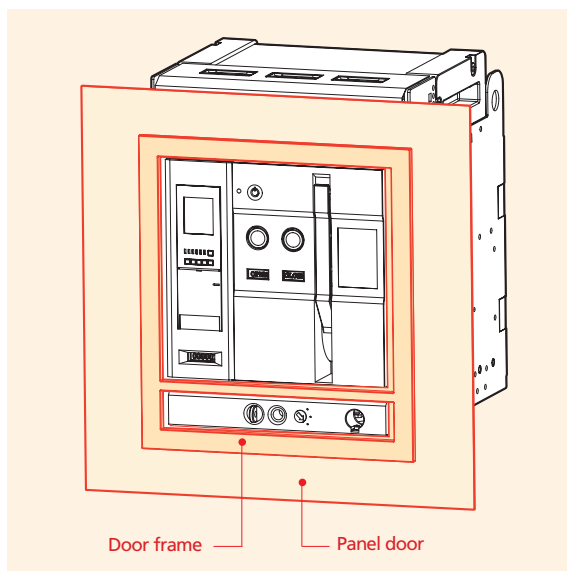
## Safety Shutter Lock [STL]



- It is locking device which prevents safety shutter from being opened when it is closed.
- If shutter lock is connected with guide shutter, the guide shutter can not be pushed structurally. Thus, it is not available to open the safety shutter.

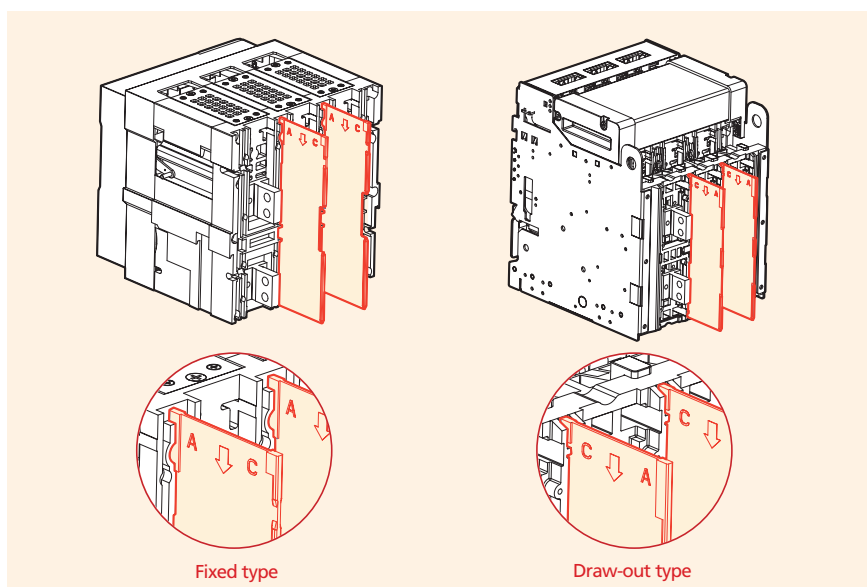
(Note) Padlocks (ø5 – ø6) are not supplied.

## Door Frame [DF]



- When structuring the embedded type of ACB panel, it protects the protrude front of ACB and the cutting side of panel door by attaching it to the panel door.

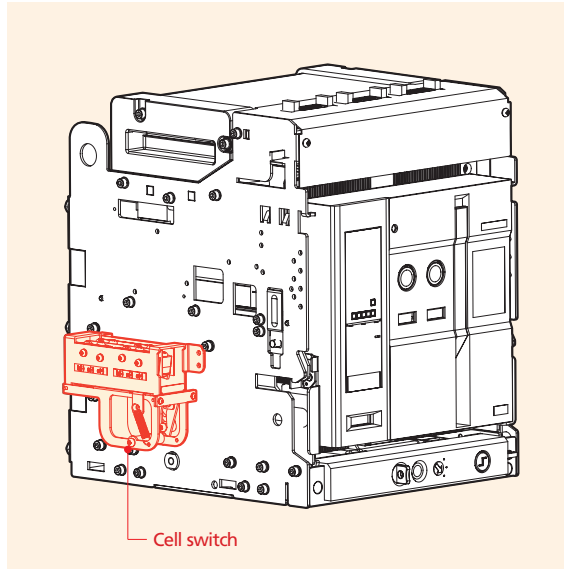
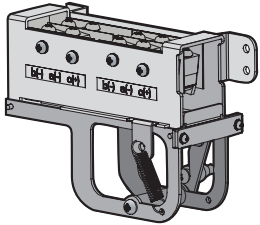
## Insulation Barrier [IB]



- Insulation barrier prevents the arc which may arise and result in short-circuit between phases in advance
- As "C" stands for "CRADLE", install the insulation barrier in the direction of "C" in case of Draw-out type.
- As "A" stands for "ACB main frame", install the insulation barrier in the direction of "A" in case of Fixed type.

# Accessories

## Cell Switch [CEL]



- It is a contact which indicates the present position of ACB.  
(CONNECTED, TEST, DISCONNECTED)

<Contact configuration>

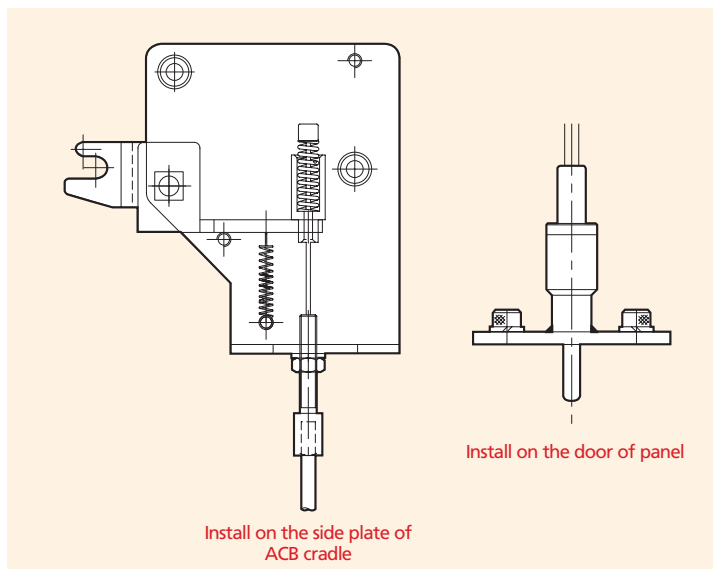
4C: 1 Disconnected + 1 Test + 2 Connected

8C: 2 Disconnected + 2 Test + 4 Connected

\*Contact configuration can be changeable if necessary.

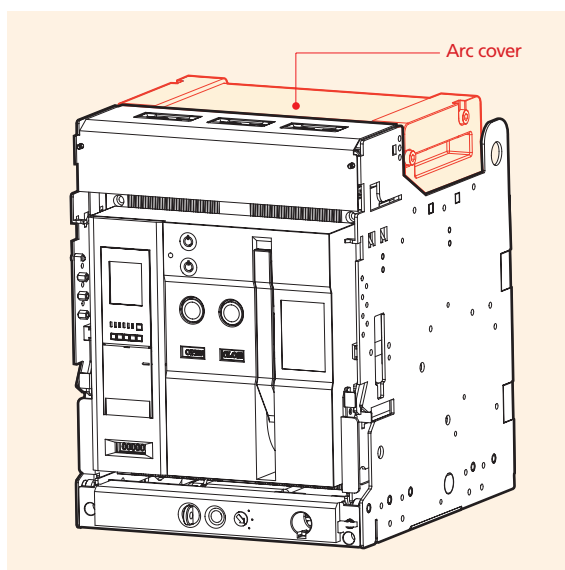
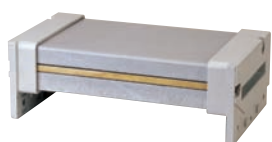
| ACB position                  |                        | DISCONNECTED |              | CONNECTED      |
|-------------------------------|------------------------|--------------|--------------|----------------|
| Draw-in and draw-out position |                        | DISCONNECTED | TEST         | CONNECTED      |
| Contact operation             | CL-C<br>(Connected)    | OFF          |              | ON             |
|                               | CL-T<br>(Test)         | OFF          | ON           |                |
|                               | CL-D<br>(Disconnected) | ON           | OFF          |                |
| Contact capacity              | Voltage (V)            |              | Revised load | Inductive load |
|                               | AC                     | 460V         | 5            | 2.5            |
|                               |                        | 250V         | 10           | 10             |
|                               |                        | 125V         |              |                |
|                               | DC                     | 250V         | 3            | 1.5            |
|                               |                        | 125V         | 10           | 10             |
| 30V                           |                        | 10           | 10           |                |
| Contact number                |                        | 4C           |              |                |

## Double Interlock [DI]



- It is a safety device which does not allow the panel door to open when a circuit breaker is in the "ON" position.

## Zero Arc Space [ZAS]

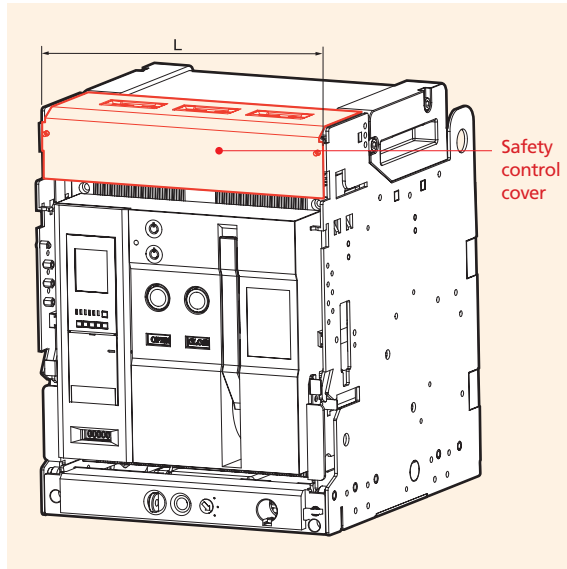
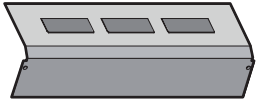


- Arc which may arise while breaking faulty current is extinguished first by Arc chute in main body of circuit breaker and the completely extinguished by Arc cover. By preventing arc from exposing to the outside, it protects itself from all kinds of accidents.
- It is categorized into 8 types by ratings and poles.

| Ampere frame | Cover length (mm) |
|--------------|-------------------|
| 2000AF 3P    | 281.4             |
| 2000AF 4P    | 366.4             |
| 4000AF 3P    | 359.4             |
| 4000AF 4P    | 474.4             |
| 5000AF 3P    | 576.4             |
| 5000AF 4P    | 746.4             |
| 6300AF 3P    | 732.4             |
| 6300AF 4P    | 962.4             |

# Accessories

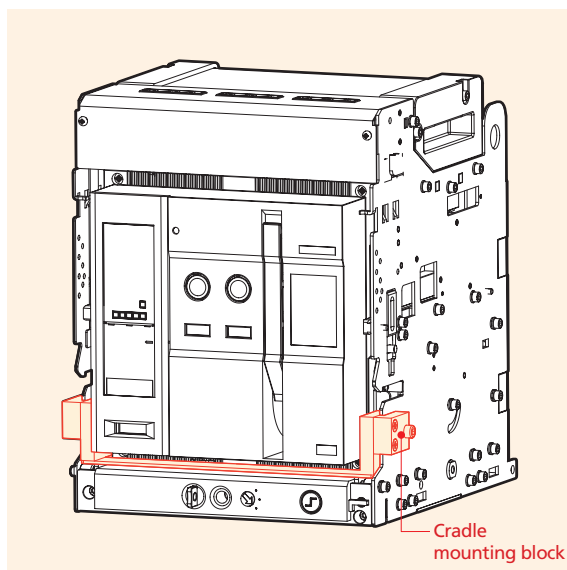
## Safety Control Cover [SC]



- It protects control terminals which exposes to the outside, and prevents the damages resulted from foreign substances.
- It is categorized into 8 types by ratings and poles.

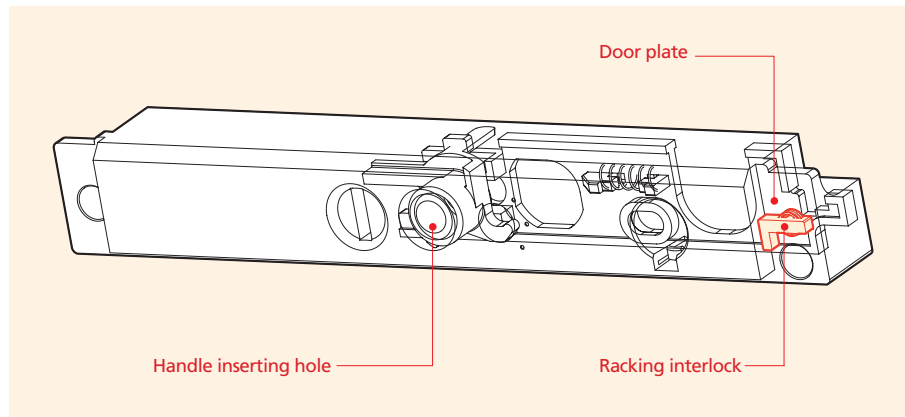
| Ampere frame | Cover length (mm) |
|--------------|-------------------|
| 2000AF 3P    | 334               |
| 2000AF 4P    | 419               |
| 4000AF 3P    | 412               |
| 4000AF 4P    | 527               |
| 5000AF 3P    | 629               |
| 5000AF 4P    | 799               |
| 6300AF 3P    | 785               |
| 6300AF 4P    | 1,015             |

## Cradle Mounting Block [CMB]



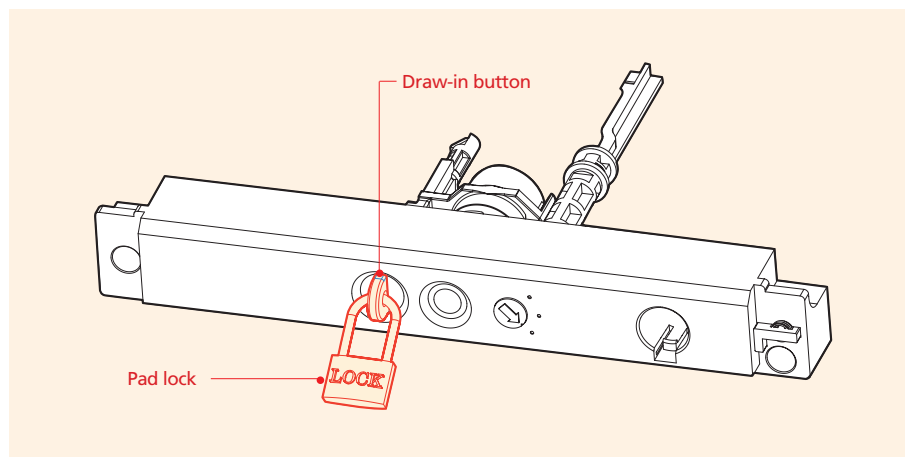
- It interlocks the main body of circuit breaker and cradle mechanically to fix the former in connected position. Therefore, all draw-in/outs are not available.

## Racking Interlock [RI]



- When panel door is opened, Draw in/out handle doesn't be inserted. Thus, panel handle can be inserted only when panel door is closed.

## Pad Lock / Position Lock [PL]

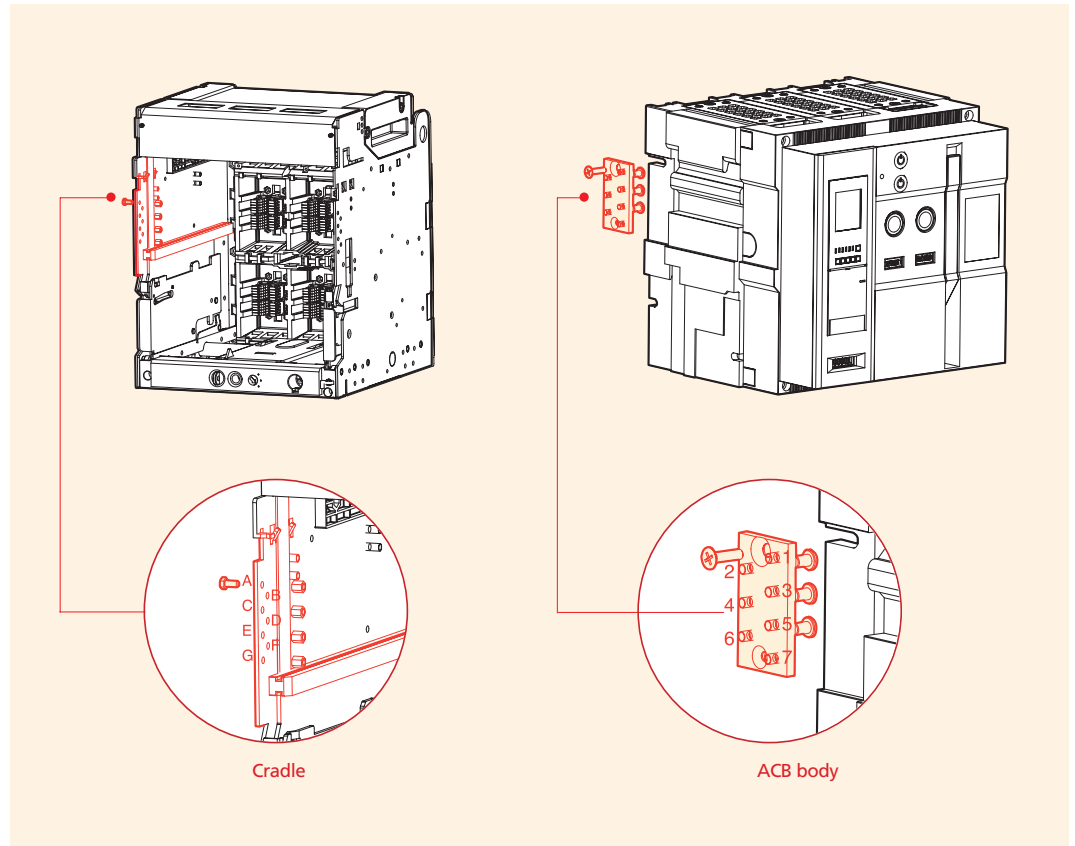


ACB is subject to restriction regarding moving in connected, test, disconnected when drawing in or out. If main body of ACB is placed in 3 positions, it is locked and stopped when drawing in or out.

- As shown in the figure, if draw-in/out button pops out, it means locking is operating.
- To continue Draw-in/out operation, release lock by pushing Draw-in/out button
- In case it is locked as shown in the figure above, main body of ACB can not be drawn in or out into the cradle.
- For the lock device, user has to purchase it. (ø5 – ø6)

# Accessories

## Miss Insertion Prevent Device [MIP]

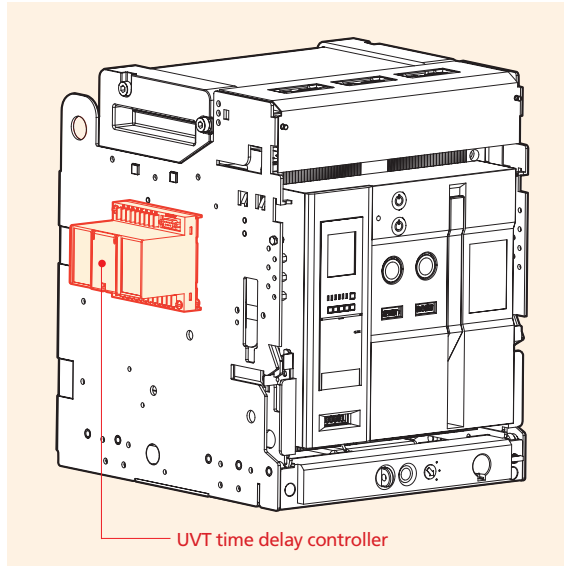
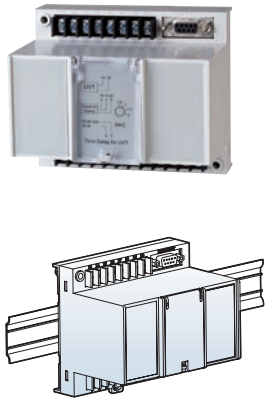


- When the main body of ACB is inserted to the cradle, if the ratings of ACB does not match with cradle, it mechanically prevents ACB from being inserted into cradle of ACB.
- The installation method is variable according to ratings.

|        |     |        |     |        |     |        |     |
|--------|-----|--------|-----|--------|-----|--------|-----|
| Cradle | ACB | Cradle | ACB | Cradle | ACB | Cradle | ACB |
| ABCD   | 567 | ADEF   | 237 | ABEG   | 346 | BCEG   | 146 |
| ABCE   | 467 | ADEG   | 236 | ABFG   | 345 | BDEF   | 137 |
| ABCF   | 457 | ADFG   | 235 | ACDE   | 267 | BDEG   | 136 |
| ABCG   | 456 | Aefg   | 234 | ACDF   | 257 | BDFG   | 135 |
| ABDE   | 367 | BCDE   | 167 | ACDG   | 256 | CDEF   | 127 |
| ABDF   | 357 | BCDF   | 157 | ACEF   | 247 | CDEG   | 126 |
| ABDG   | 356 | BCDG   | 156 | ACEG   | 246 | CEFG   | 124 |
| ABEF   | 347 | BCEF   | 147 | ACFG   | 245 | DEFG   | 123 |



## UVT Time Delay Controller [UDC]



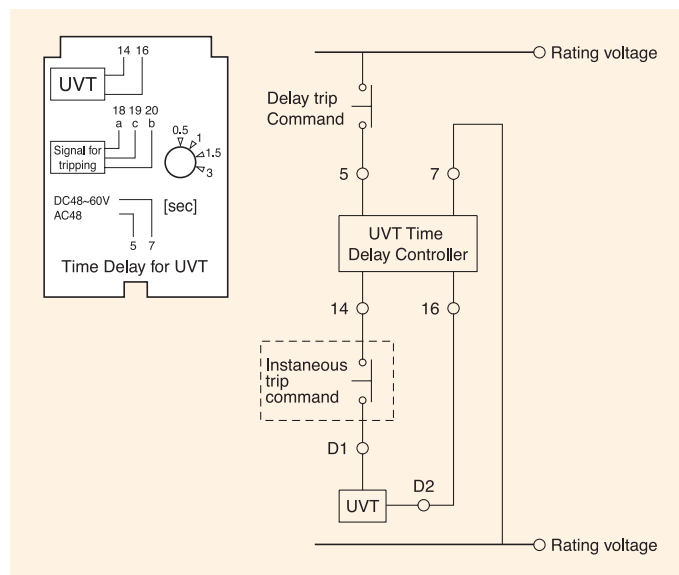
- UVT is a device which makes ACB tripped automatically to prevent the accident on load side due to under voltage or power breakdown. There are two types, Instantaneous type and time delay type.
- It can be installed on the rail or to the cradle.
- Instantaneous type: only available with UVT coil.
- Time delay type: available by connecting UVT coil and UVT time delay controller.
- Common use for the all types.

### 1. The rated voltage and characteristics of UVT time delay controller

| Rated voltage [Vn] |           | Operating voltage range [V] |               | Power consumption (VA or W) |              | Trip time [ms] |
|--------------------|-----------|-----------------------------|---------------|-----------------------------|--------------|----------------|
| DC [V]             | AC [V]    | Pick up                     | Drop out      | Inrush                      | Steady-state |                |
| 48 – 60            | 48        | 0.65 – 0.85 Vn              | 0.4 – 0.65 Vn | 200                         | 5            | 0.5, 1, 1.5, 3 |
| 100 – 130          | 100 – 130 |                             |               |                             |              |                |
| 200 – 250          | 200 – 250 |                             |               |                             |              |                |
| -                  | 380 – 480 |                             |               |                             |              |                |

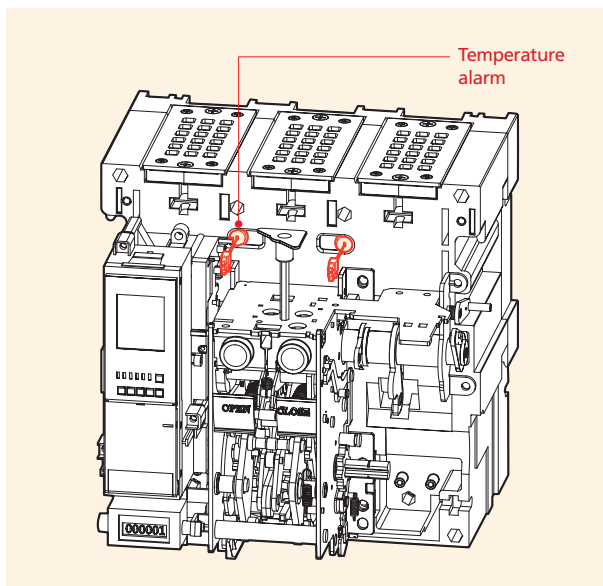
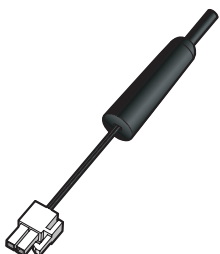
Note) Operating voltage range is the min. rated standard for each rated voltage (Vh).

### 2. Wiring



# Accessories

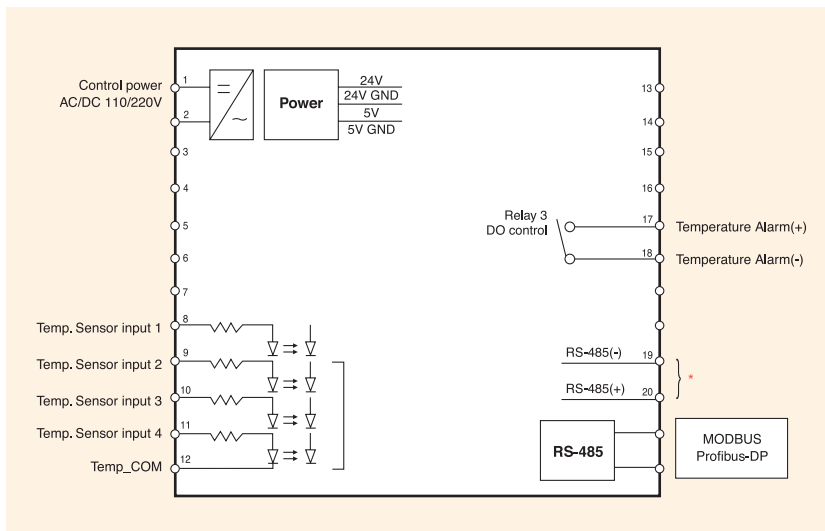
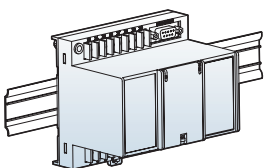
## Temperature Alarm [TM]



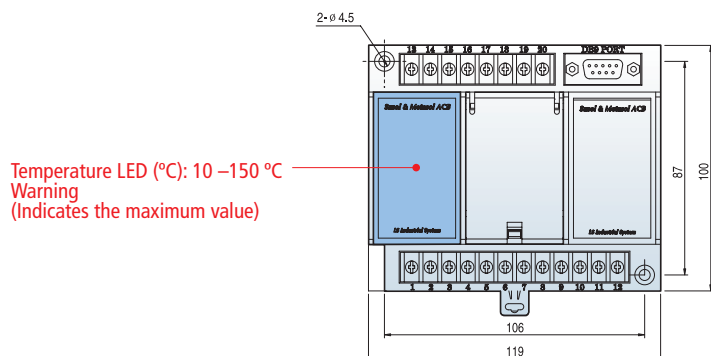
- Temperature Alarm Unit is a device to show the temperature through a sensor inside of ACB.
- The temperature sensor can be installed up to 4 and the output is connected to control terminal blocks.
- It displays the maximum temperature of them and transmits through a network.
- If the temperature is higher than a standard, an alarm can occur.
- Temperature alarm unit communicates with Modbus/RS-485 basically, Profibus-DP need to be purchased separately.
- Temperature alarm unit is installed on the cradle or the inside of panel.



Temperature alarm



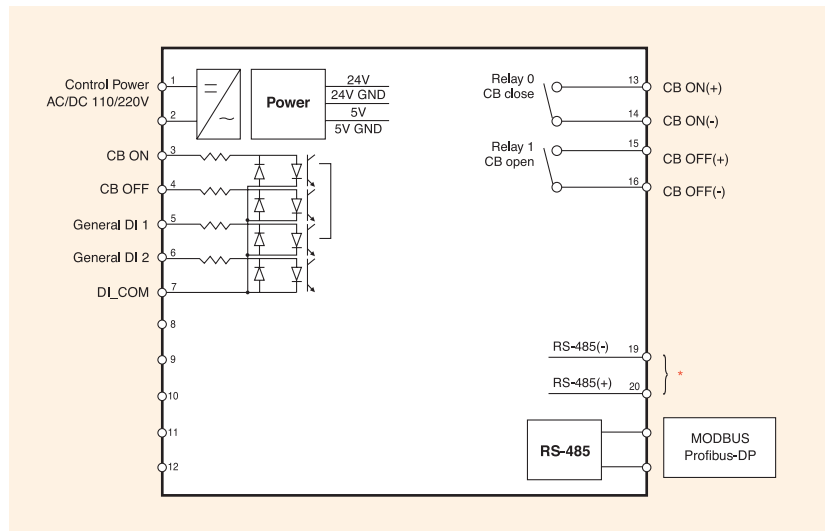
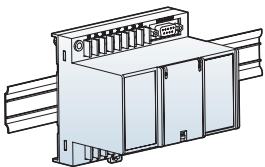
\* In case of using Profibus-DP communication, it needs to communicate with ACB trip relay.



## Remote I/O Unit [RCO]

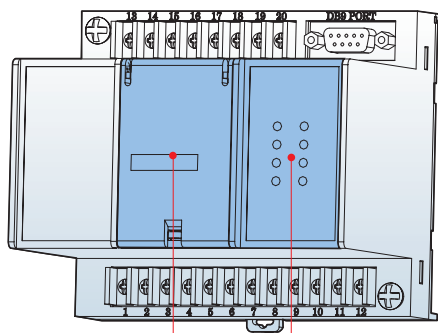


Remote I/O unit



\* In case of using Profibus-DP communication, it needs to communicate with ACB trip relay.

| Classification |                            | Applied range         | Remarks   |
|----------------|----------------------------|-----------------------|---|
| CB control     | Contact switching capacity | AC 230V 16A/DC30V 16A |   |
|                | Max. switching capacity    | 3680VA, 480W          |   |
| Alarm          | Contact switching capacity | AC 230V 6A/DC25V 6A   | Induction load<br>( $\cos\phi = 0.4, L/R = 7ms$ ) |
|                | Max. switching capacity    | 1880VA, 150W          |   |



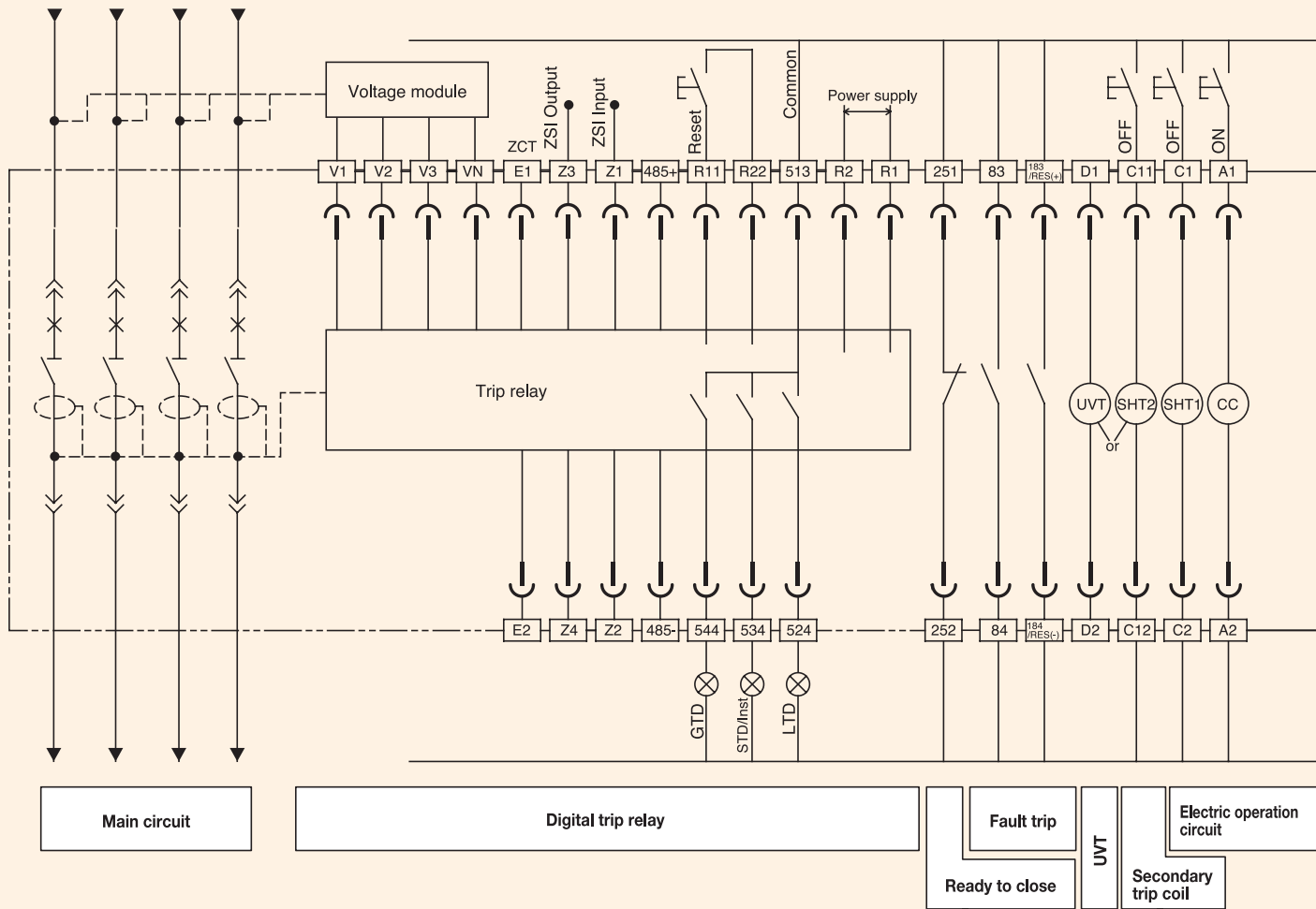
- Baud rate setting
- Comm. address setting
- Temperature setting

- Remote I/O unit has the I/O contact which can trip or close the ACB from the remote site by communication.
- For the General DO, the output of DI1 or DI2 is selectable.
- Remote I/O unit communicates with Modbus/RS-485 communication basically, Profibus-DP need to be purchased separately.
- It supports SBO (Select Before Operation) function and guarantees the control reliability.
- Remote I/O unit can be installed on the cradle of ACB or the inside of panel.

| LED |          | Remarks  |
|-----|----------|--|
| 1   | DI1      | Indicates digital Input #1condition                                  |
| 2   | DI2      | Indicates digital Input #2condition                                  |
| 3   | DO ON    | Indicates temperature alarm output is ON                             |
| 4   | DO OFF   | Indicates temperature alarm output is OFF                            |
| 5   | CB ON    | Indicates circuit break close condition                              |
| 6   | CB OFF   | Indicates circuit break open condition                               |
| 7   | RUN LED  | Indicates unit run condition   |
| 8   | CB ERROR | Indicates circuit break terminal Disconnection/control Err condition |

# Electrical diagram

This diagram is based on "CONNECTED" position of circuit breaker and Opening, Motor charging, Releasing of locking plate should be normal condition.



## Terminal code description

|     |     |   |    |    |                              |
|-----|-----|---|----|----|------------------------------|
| 13  | 14  | - | 63 | 64 | Auxiliary switch "a"         |
| 11  | 12  | - | 61 | 62 | Auxiliary switch "b"         |
| 413 | 412 |   |    |    | Charged signal               |
| 423 | 422 |   |    |    | Charged signal oommunication |
| U1  | U2  |   |    |    | Motor charging               |
| A1  | A2  |   |    |    | Closing coil                 |
| C1  | C2  |   |    |    | Shunt trip                   |
| C11 | C12 |   |    |    | 2nd shunt trip               |

|      |       |   |
|------|-------|---|
| D1   | D2    | Voltage input terminal of UVT               |
| 83   | 84    | Alarm1 "a"                                  |
| 183  | 184   | Alarm2 "a"                                  |
| 251  | 252   | Ready to close switch                       |
| R1   | R2    | Control power                               |
| 513  | - 514 | Alarm contact                               |
| R11  | R22   | Alarm reset (Trip cause LED, Alarm contact) |
| 485+ | 485-  | RS-485 communication                        |

Note) 1. The diagram is shown with circuits de-energied, all devices open, connected and charged and relays in normal position

2. Relay is normal condition and charging type is "OFF-Charging"

3. The standard of auxiliary contact is 3a3b. The auxiliary switch in above diagram is composed of 5a5b. See 59 page for more detail on auxiliary switches.

4. Option

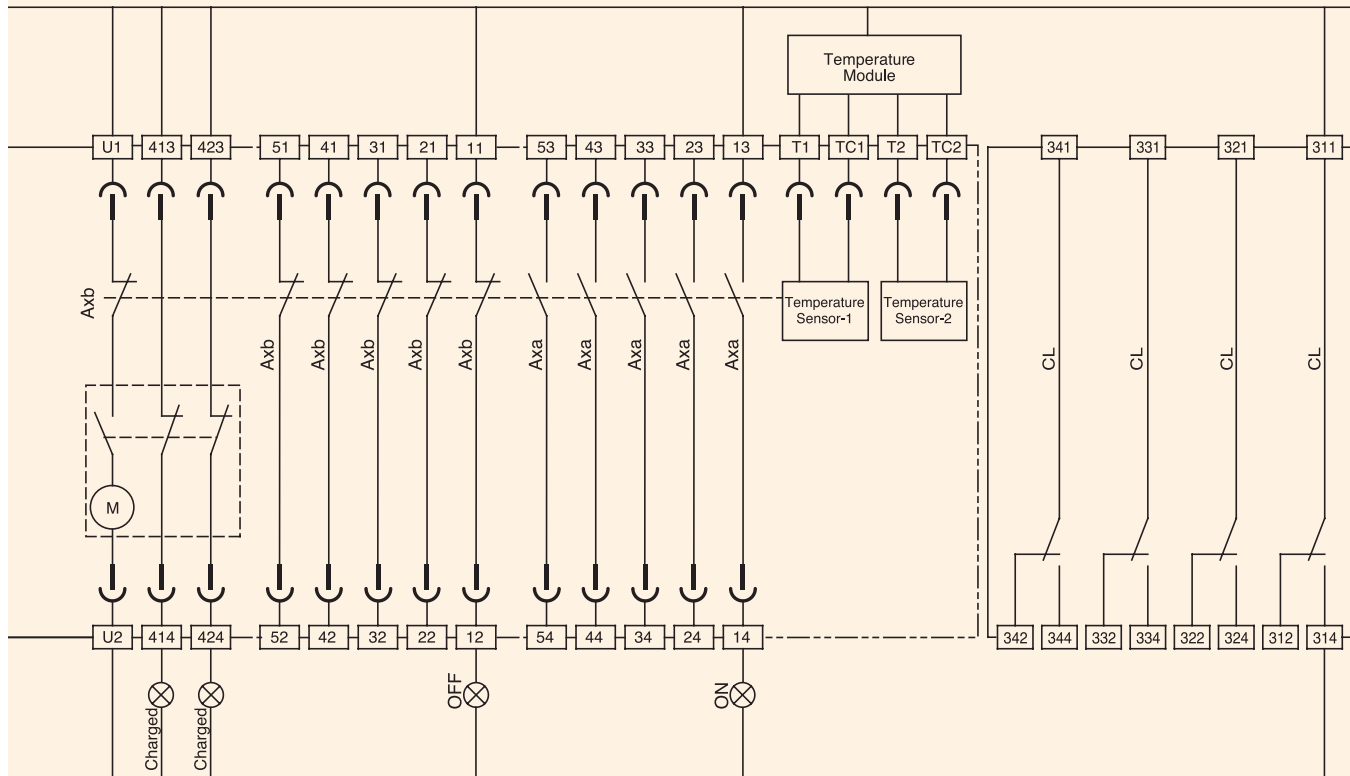
- Ready to close contact, Trip alarm contact, UVT coil, Fully charged contact, secondary trip coil

- Cell switch, Temperature module, Voltage module, Remote close-open module, ZCT, ZSI

5. Please consult us for the use of ZSI (Zone selective Interlocking).

6. Refer to the page 44 for the connection of Trip relay and the page 54 for UVT.

7. For connecting RS-485 verify if the polarity is correct



Charge completion contact

Auxiliary switch

Thermal, communication remote control module

Cell switch

### Accessory code description

|          |        |                    |
|----------|--------|--------------------|
| Z1       | Z2     | ZSI input          |
| Z3       | Z4     | ZSI output         |
| E1       | E2     | ZST                |
| VN       | V3     | Voltage module     |
| TC1, TC2 | T1, T2 | Temperature module |
| 311      | 344    | Position switch    |

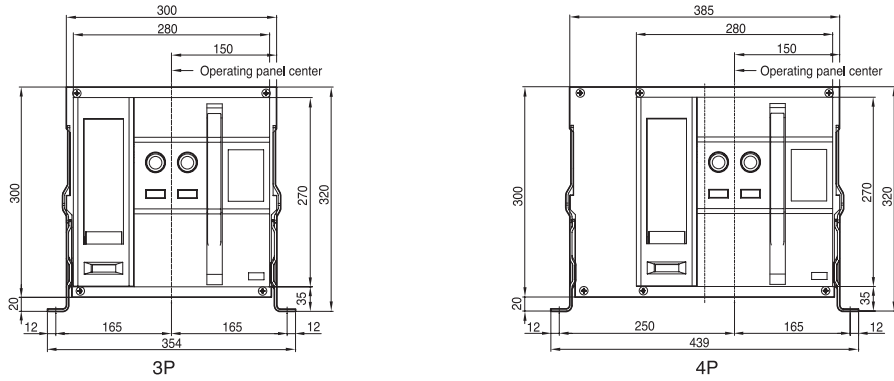
|          |                                |
|----------|--------------------------------|
| Ax       | Auxiliary switch               |
| LTD      | Long time delay trip indicator |
| STD/Inst | Short time delay/instantaneous |
| GTD      | Ground fault trip indicator    |
| CL       | Cell switch                    |
| (M)      | Motor                          |
| (CC)     | Closing coil                   |
| (SH1)    | Shunt tripping device 1        |
| (SH2)    | Shunt tripping device 2        |
| (UVT)    | UVT coil                       |

|   |   |
|---|---|
| — | Internal wiring   |
| — | External wiring (by customer)                             |
| ⌋ | Connector of the control circuit terminal of drawout type |

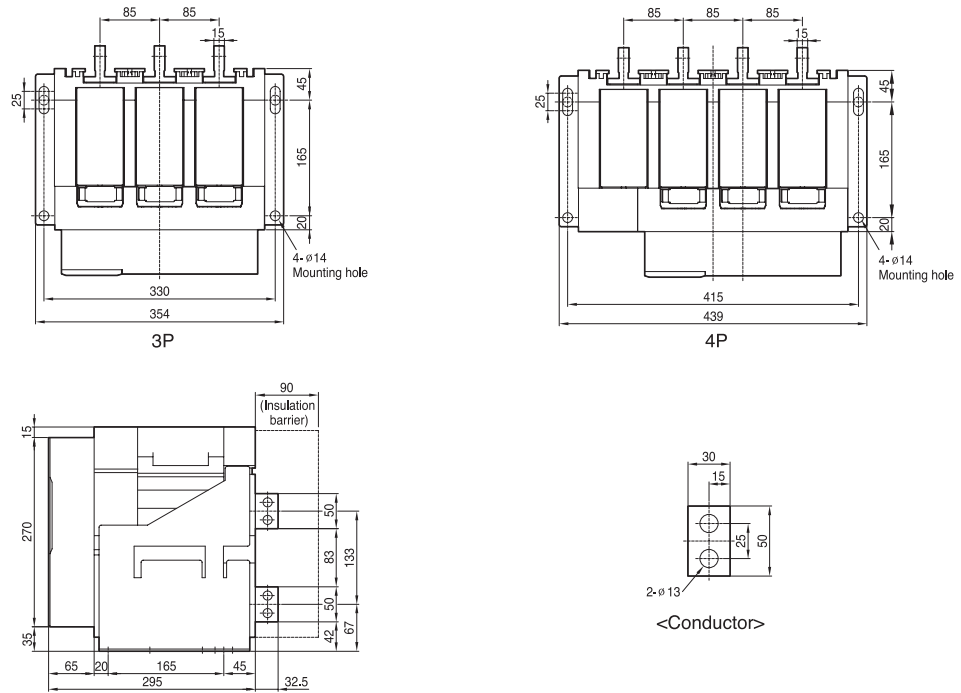
# Dimensions

## Fixed type 2000AF (630 – 1600A: AKH / AKN / AKS-06 – 16D)

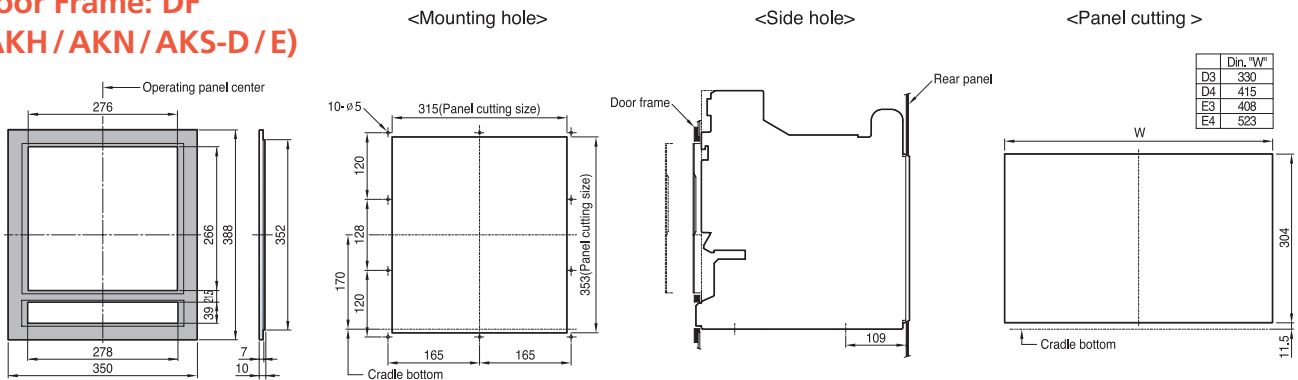
### Front view



### Vertical type

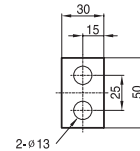
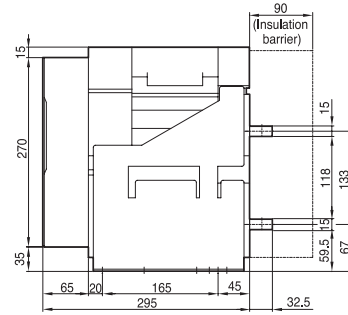
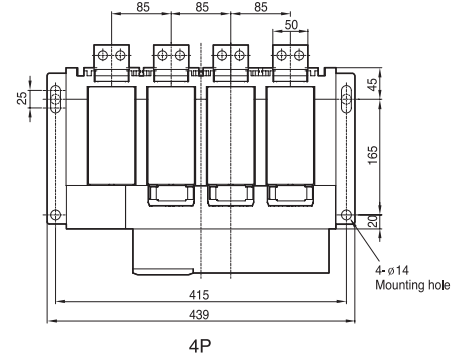
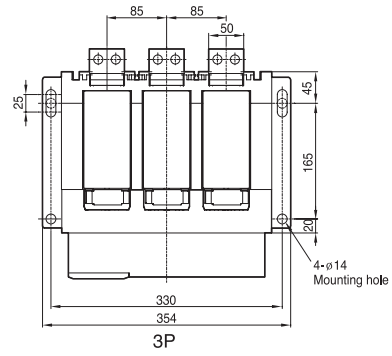


### Door Frame: DF (AKH / AKN / AKS-D / E)



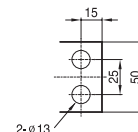
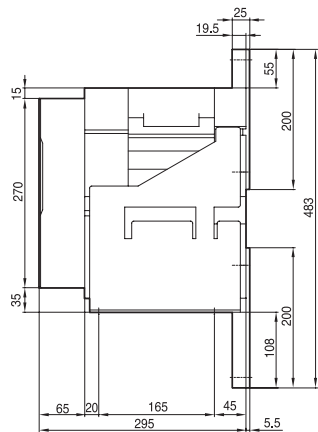
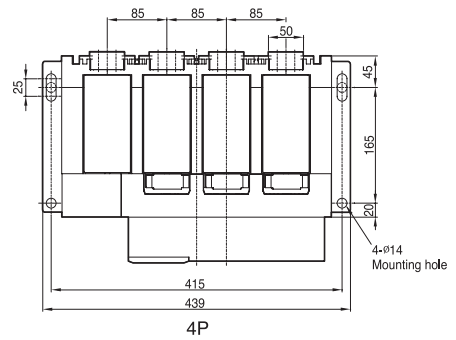
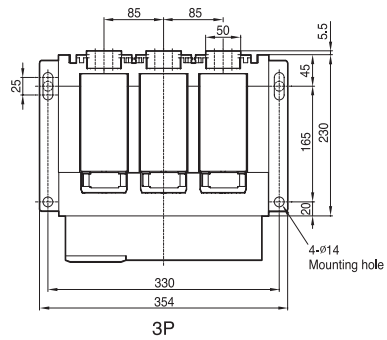
Note) The dimensions are for drawout type.

## Horizontal type



<Conductor>

## Front connection type

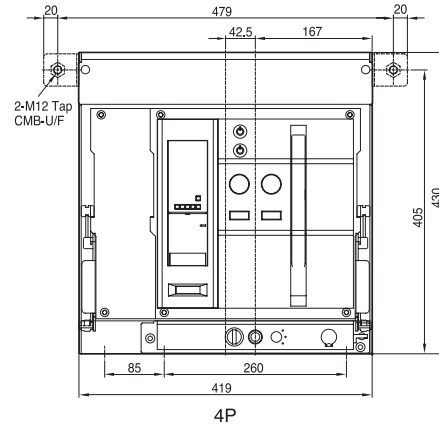
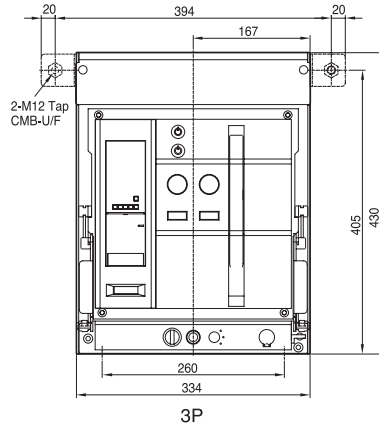


<Conductor>

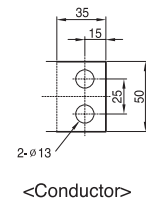
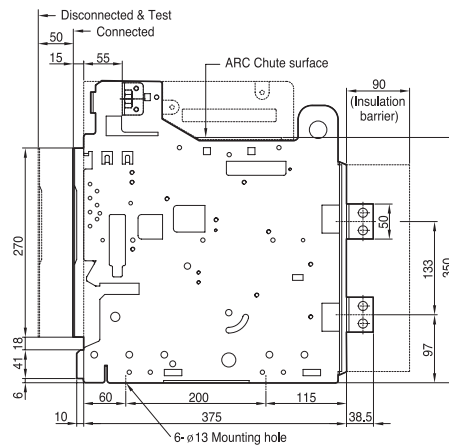
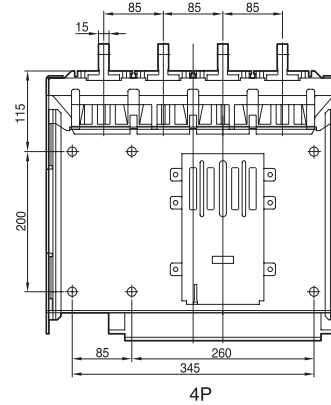
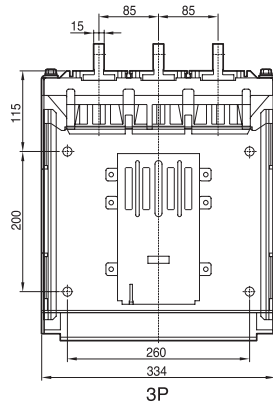
# Dimensions

## Draw-out type 2000AF (630 – 1600A: AKH / AKN / AKS-06 – 16D)

### Front view

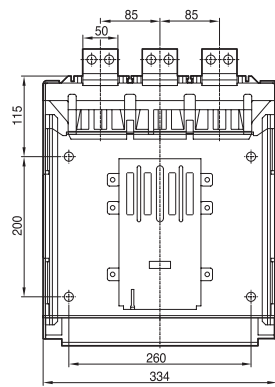


### Vertical type

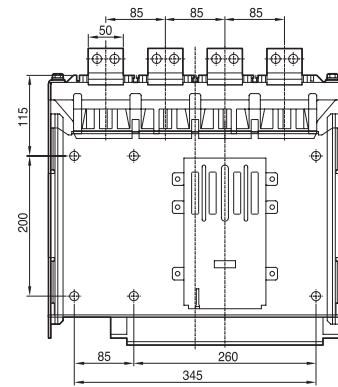




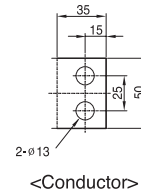
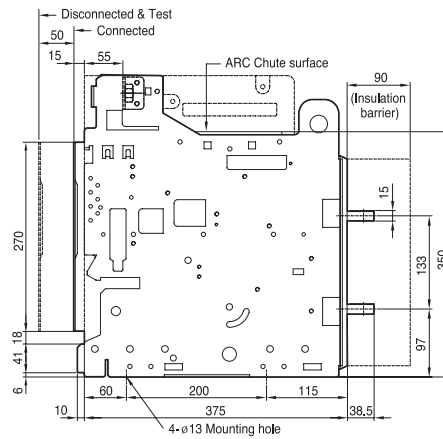
## Horizontal type



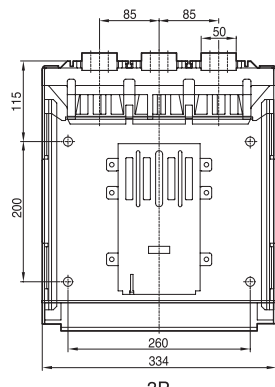
3P



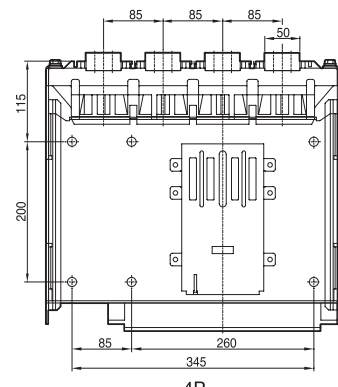
4P



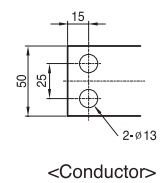
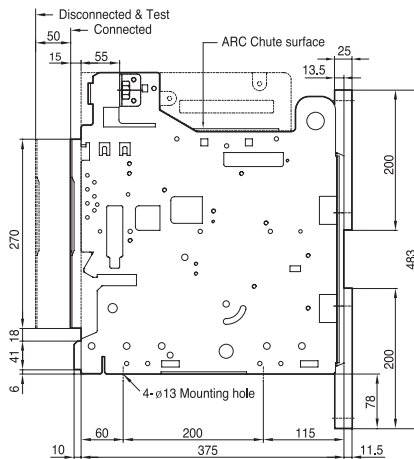
## Front connection type



3P



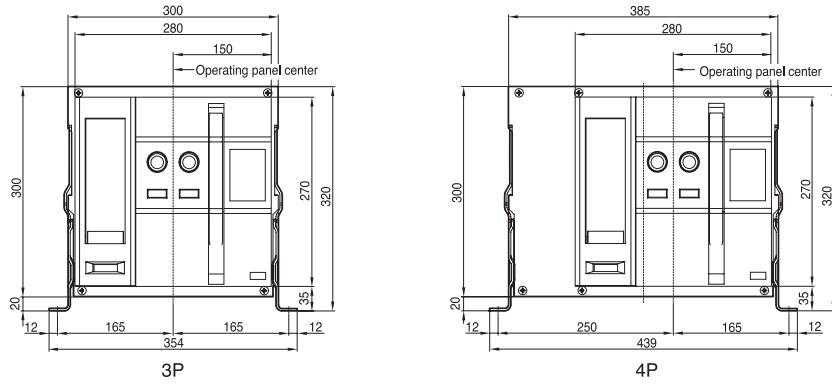
4P



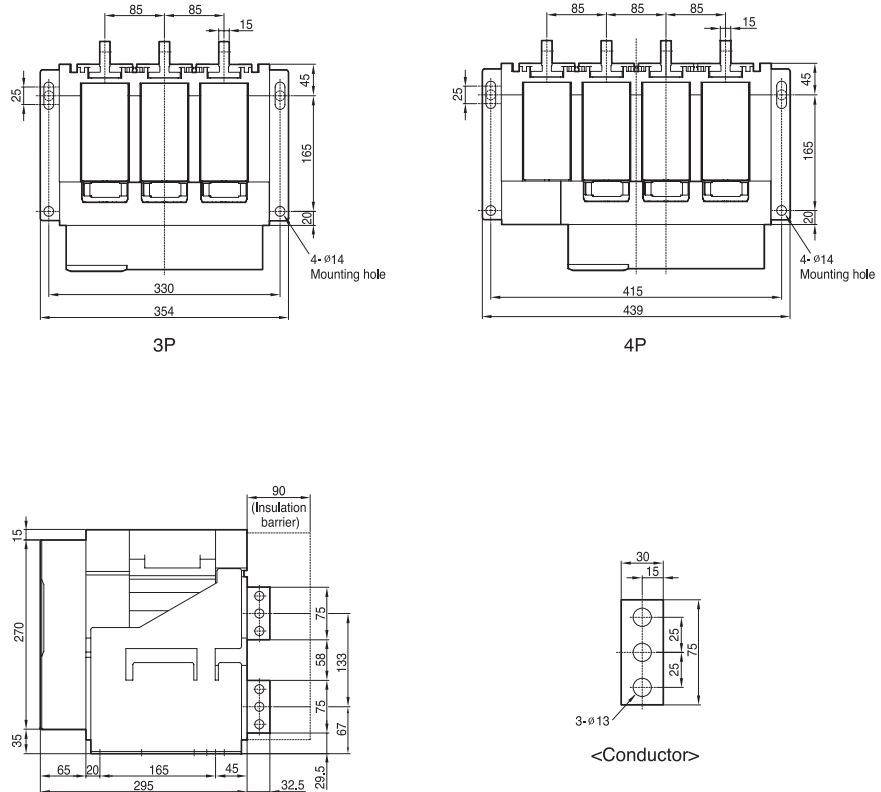
# Dimensions

## Fixed type 2000AF (2000A: AKH / AKS-20D)

### Front view

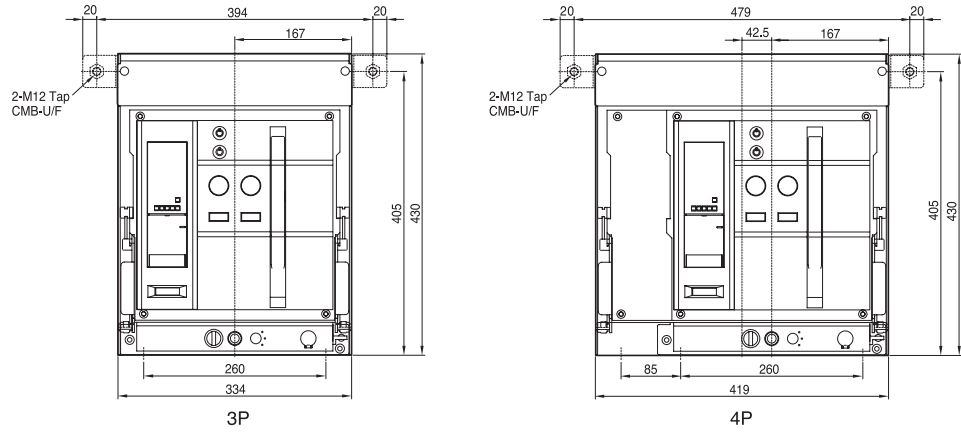


### Vertical type

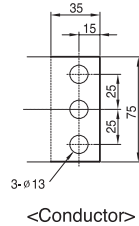
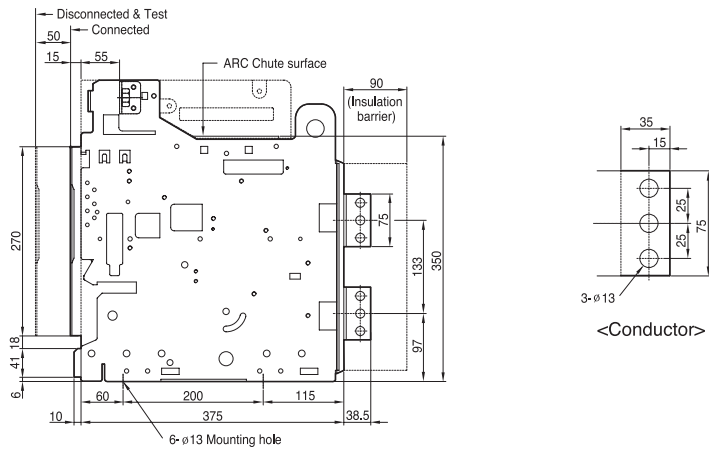
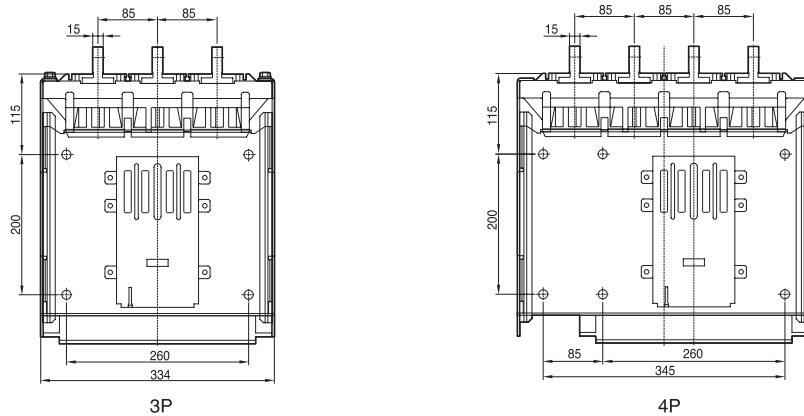


# Draw-out type 2000AF (2000A: AKH / AKS-20D)

## Front view



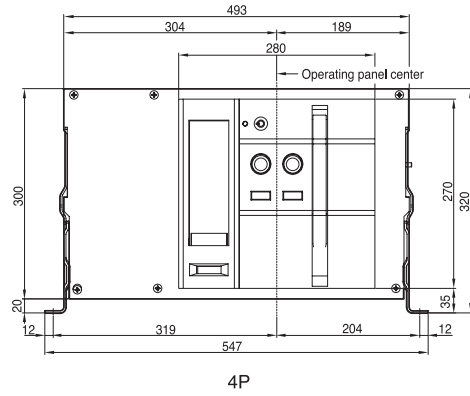
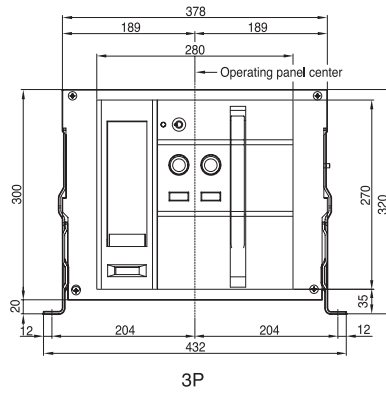
## Vertical type



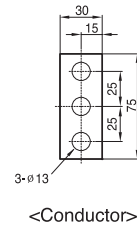
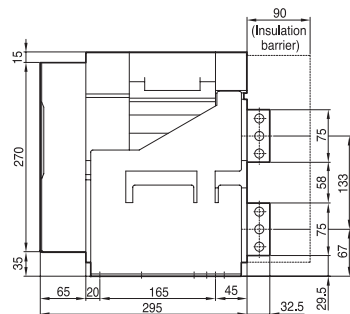
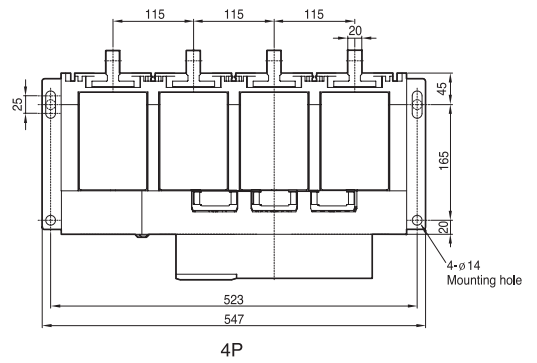
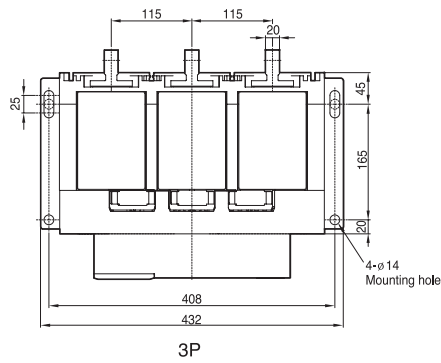
# Dimensions

## Fixed type 4000AF (2000 – 3200A: AKH / AKN / AKS-20 – 32E)

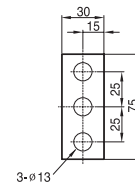
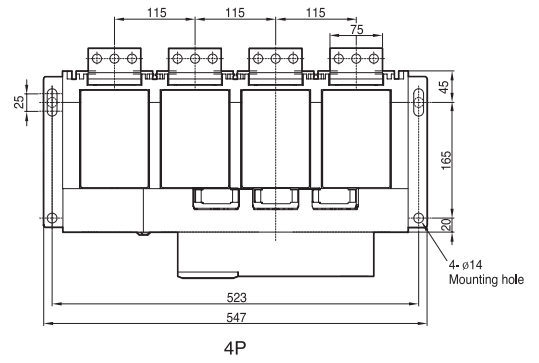
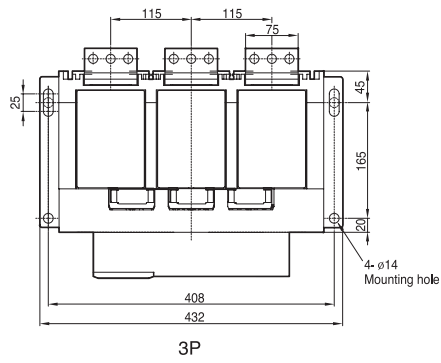
### Front view



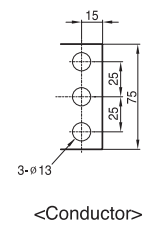
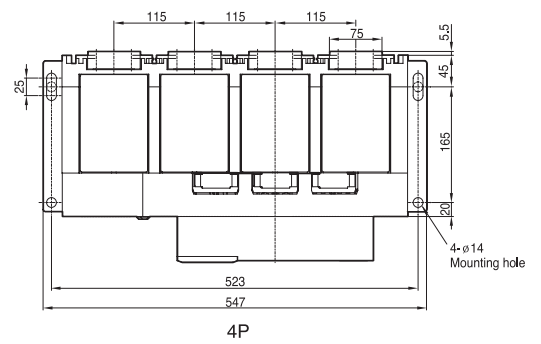
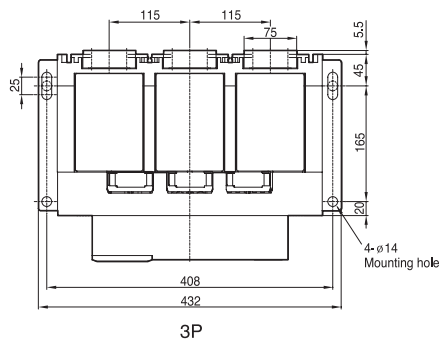
### Vertical type



## Horizontal type



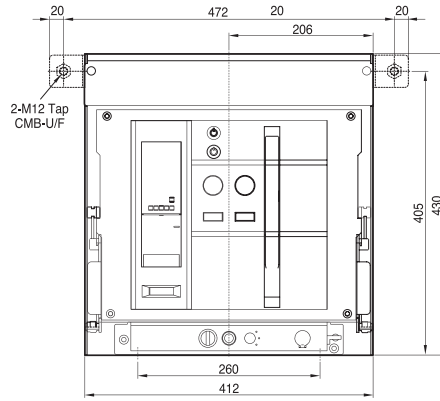
## Front connection type



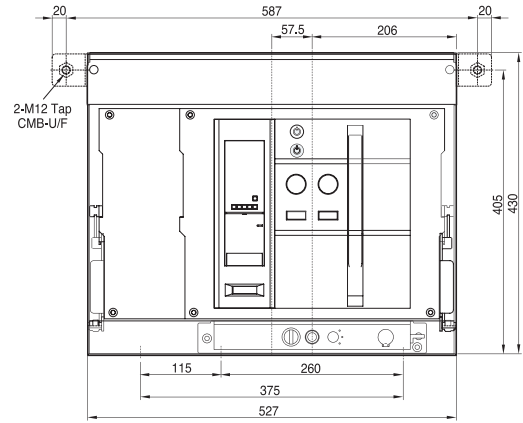
# Dimensions

## Draw-out type 4000AF (2000 – 3200A: AKH / AKN / AKS-20 – 32E)

### Front view

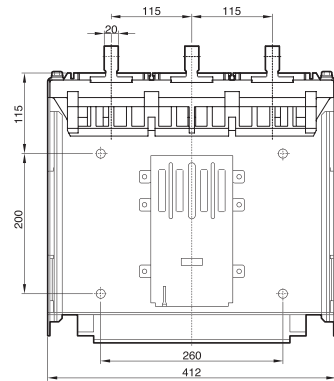


3P

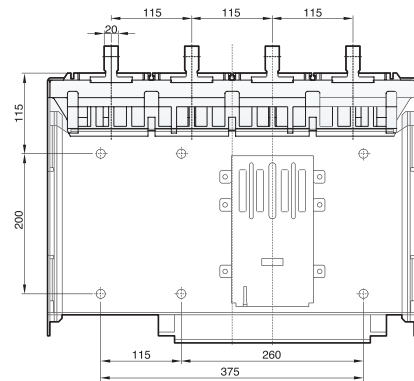


4P

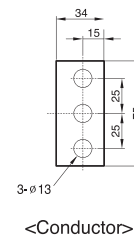
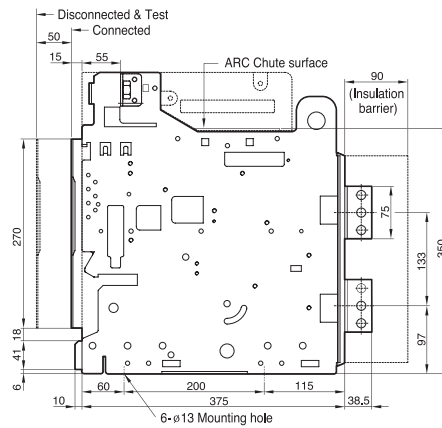
### Vertical type



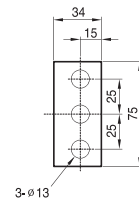
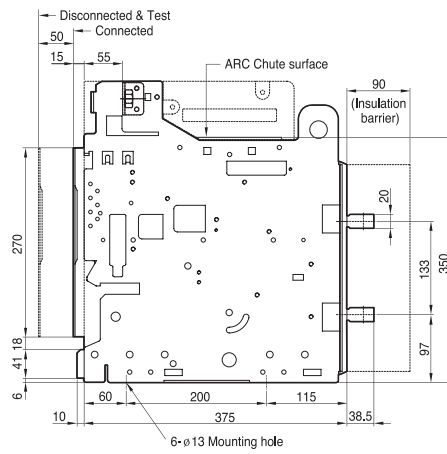
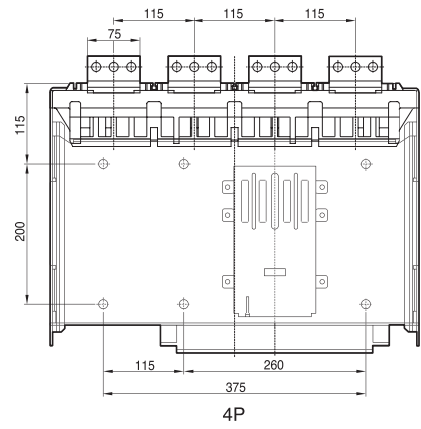
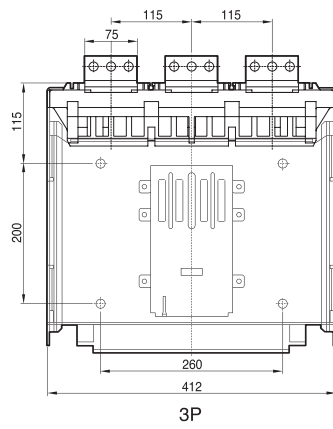
3P



4P

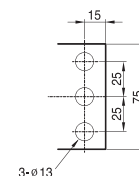
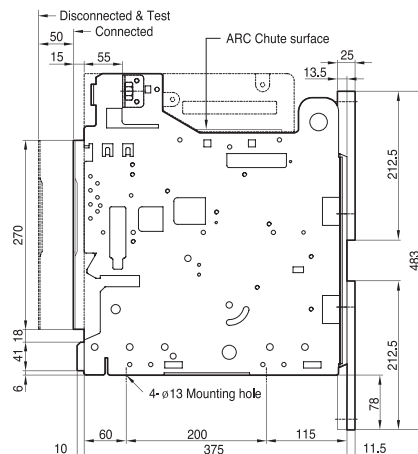
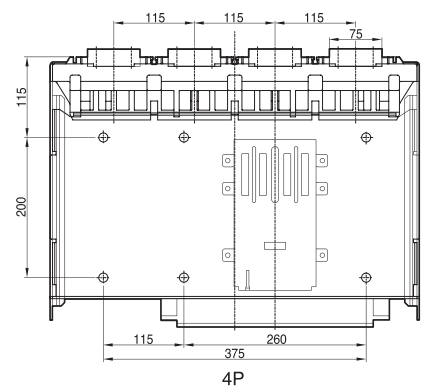
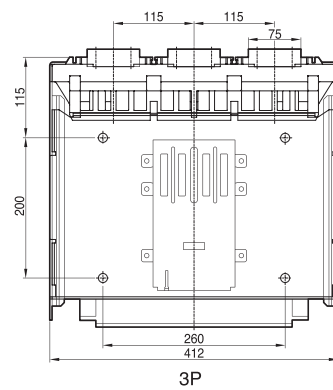


## Horizontal type



<Conductor>

## Front connection type

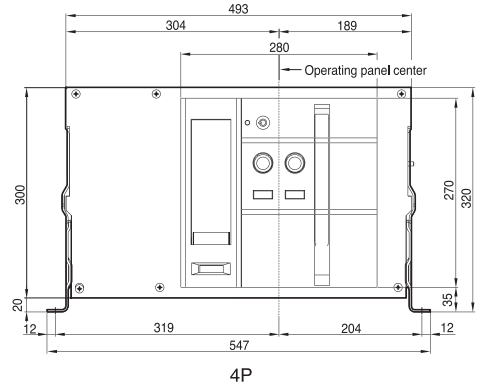
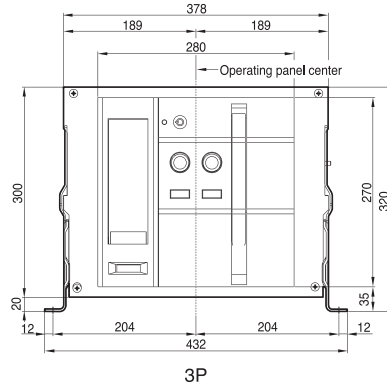


<Conductor>

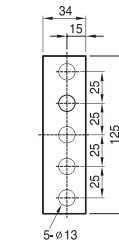
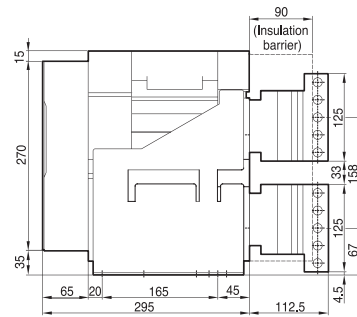
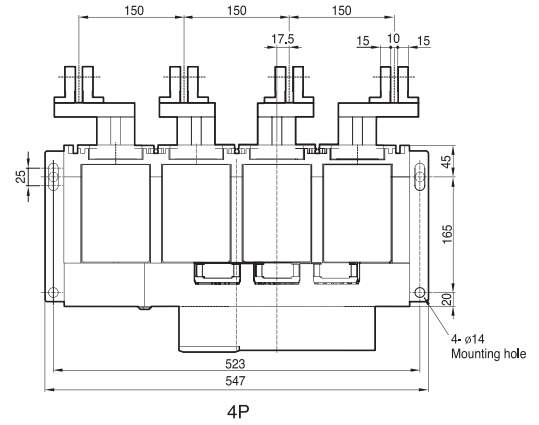
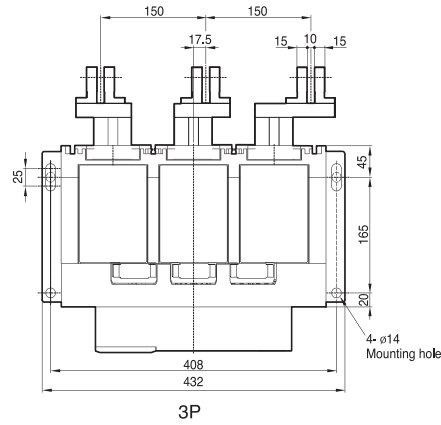
# Dimensions

## Fixed type 4000AF (4000A: AKH / AKS40E)

### Front view



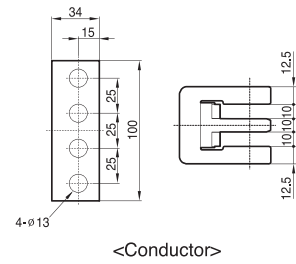
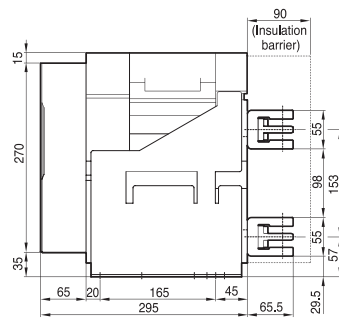
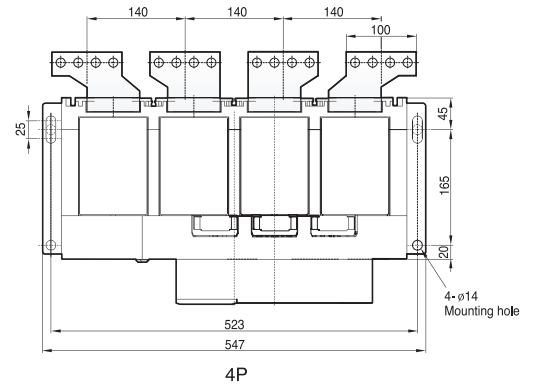
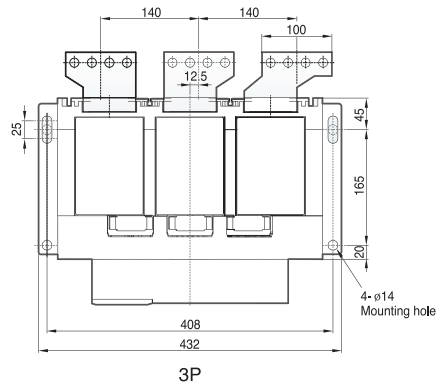
### Vertical type



<Conductor>



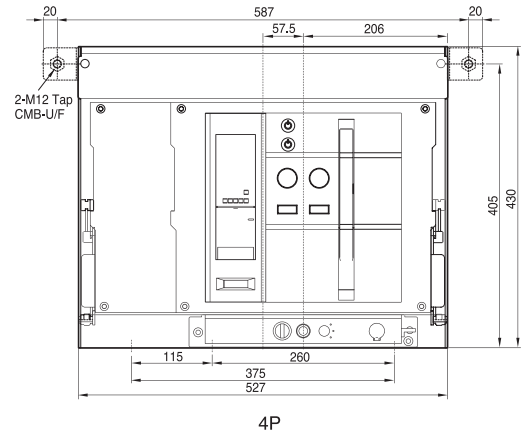
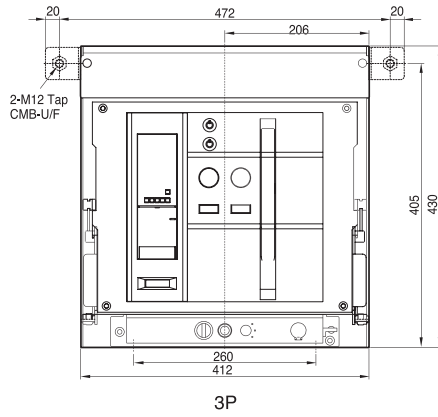
## Horizontal type



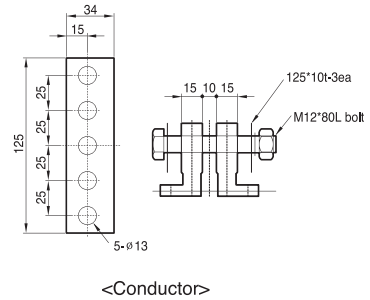
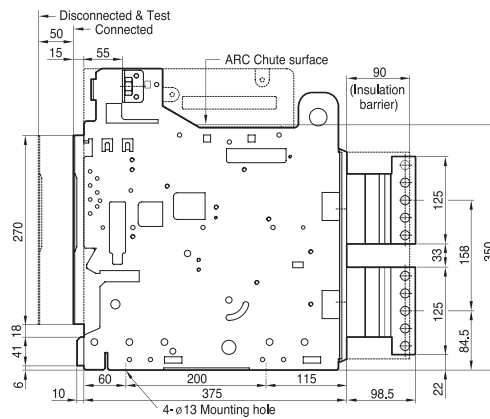
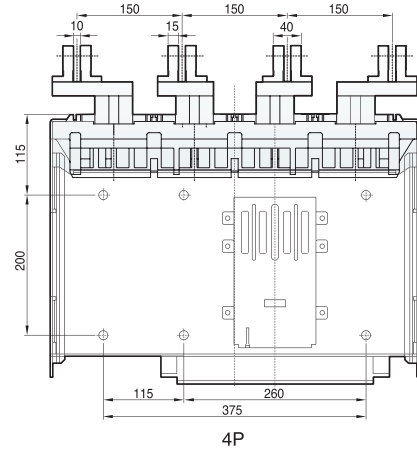
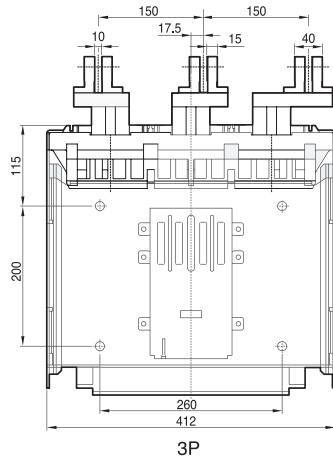
# Dimensions

## Draw-out type 4000AF (4000A: AKH / AKS-40E)

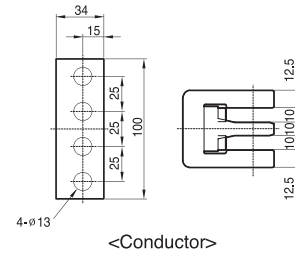
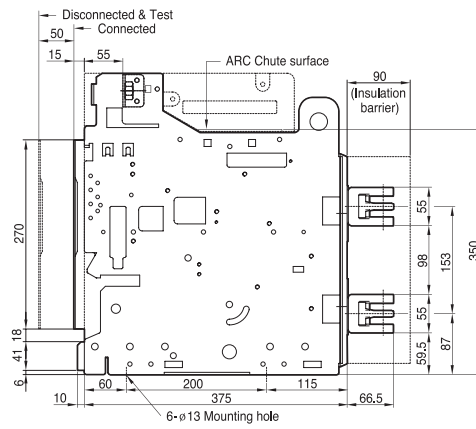
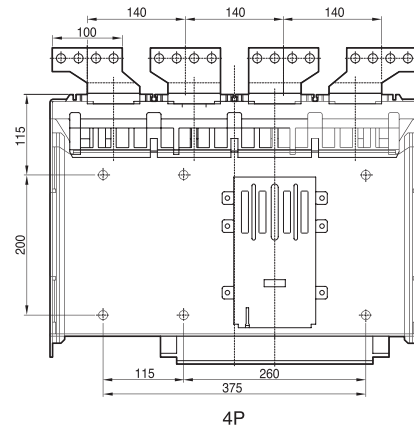
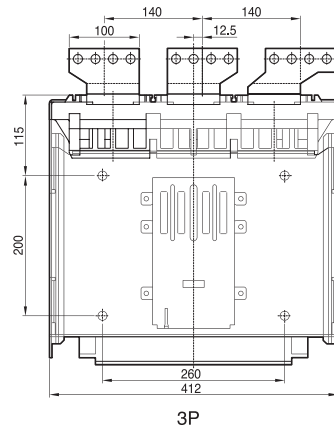
### Front view



### Vertical type



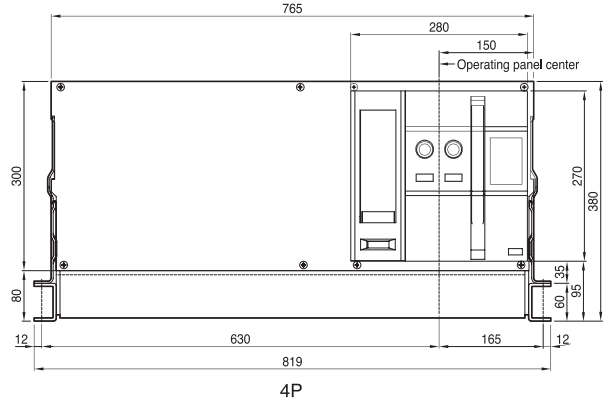
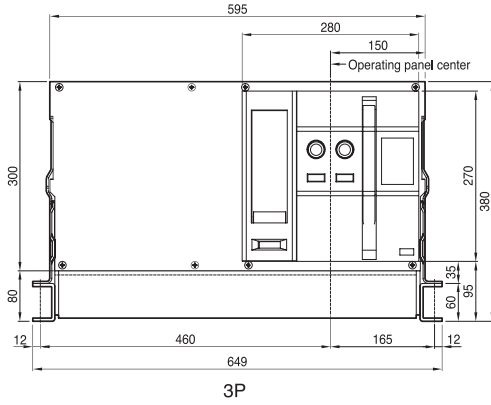
## Horizontal type



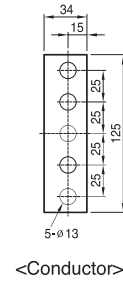
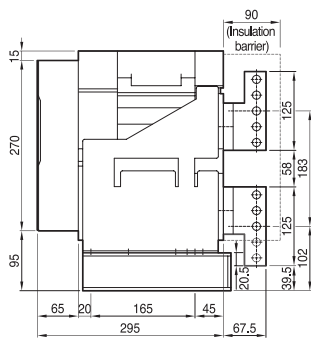
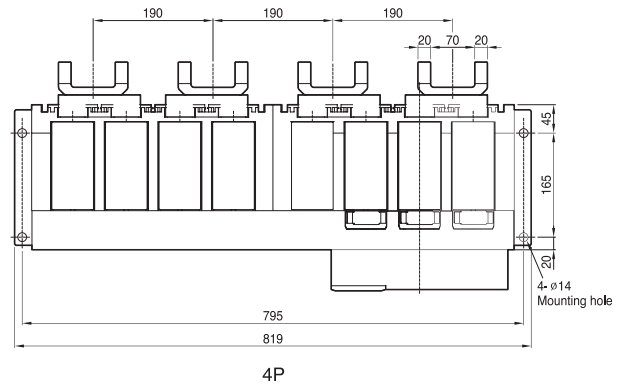
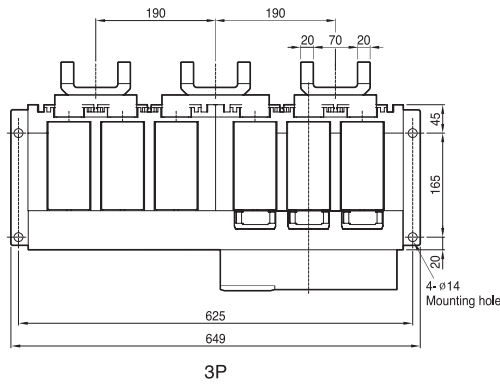
# Dimensions

## Fixed type 5000AF (4000 – 5000A: AKS-40 – 50F)

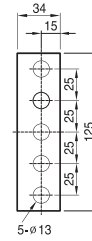
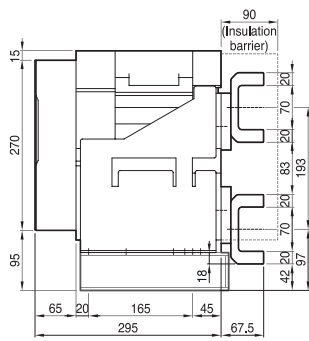
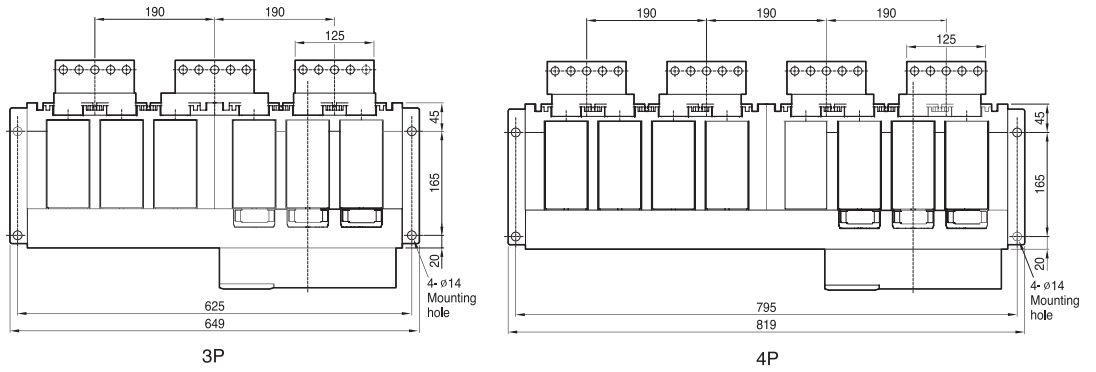
### Front view



### Vertical type

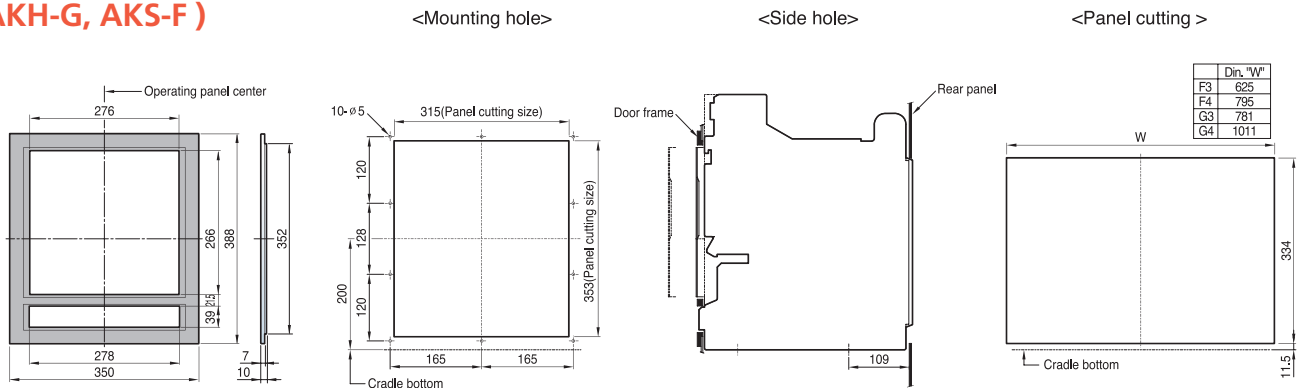


## Horizontal type



<Conductor>

## Door Frame: DF (AKH-G, AKS-F)



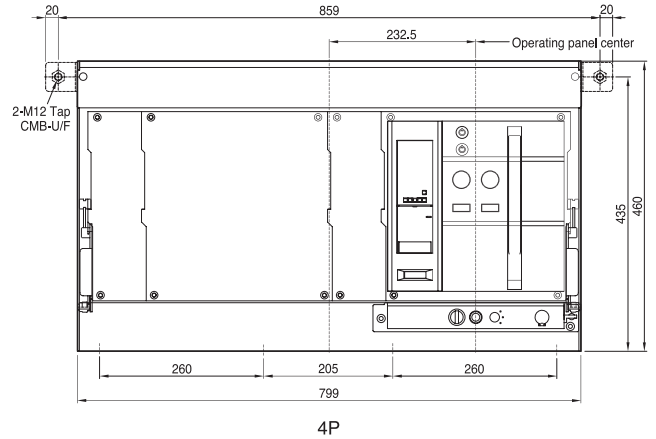
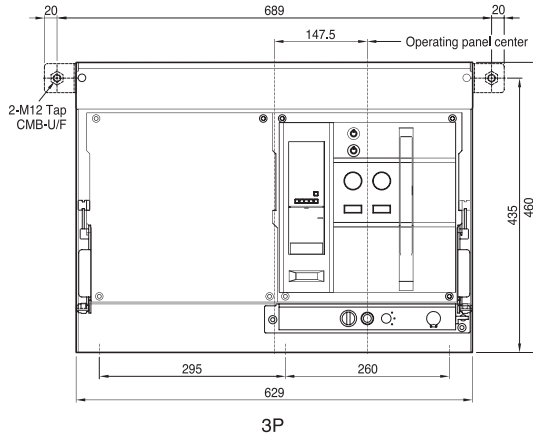
<External size>

Note) The dimensions are for drawout type.

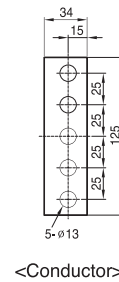
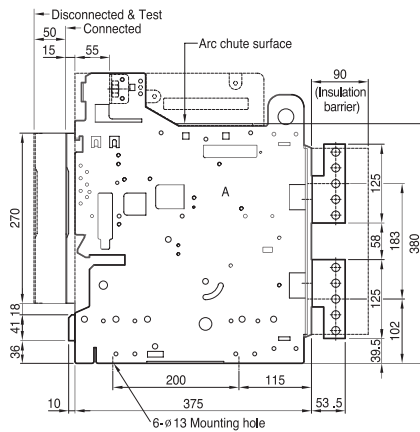
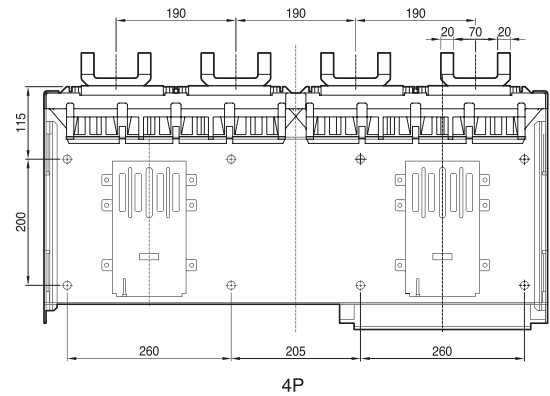
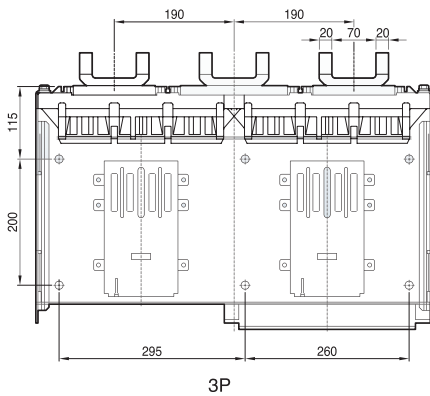
# Dimensions

## Draw-out type 5000AF (4000 – 5000A: AKS-40 – 50F)

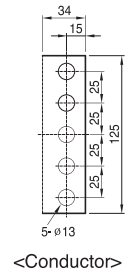
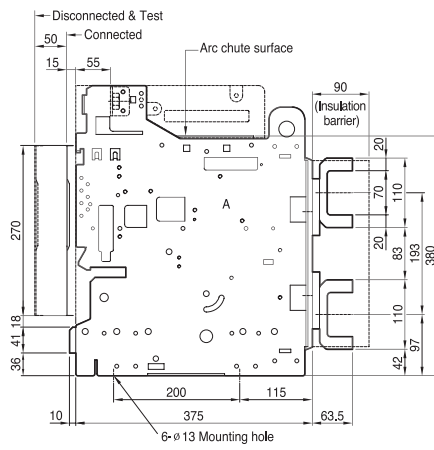
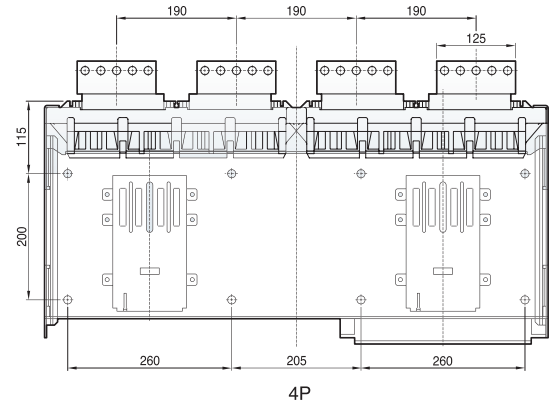
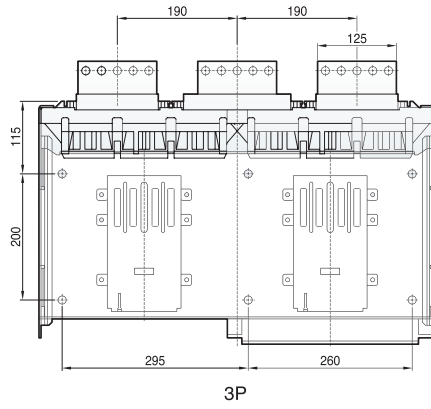
### Front view



### Vertical type



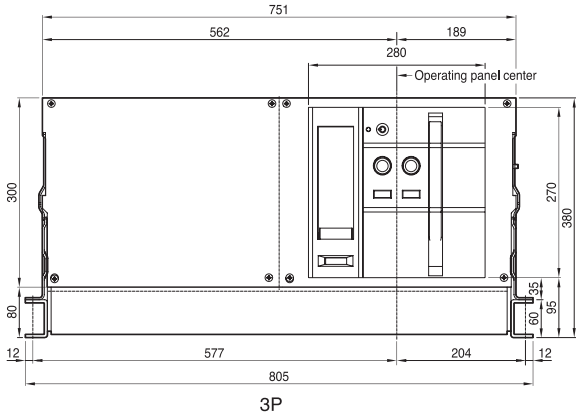
## Horizontal type



# Dimensions

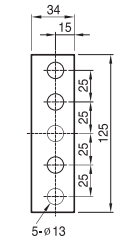
## Fixed type 6300AF (4000 – 6300A: AKH / AKS-40 – 50G)

### Front view

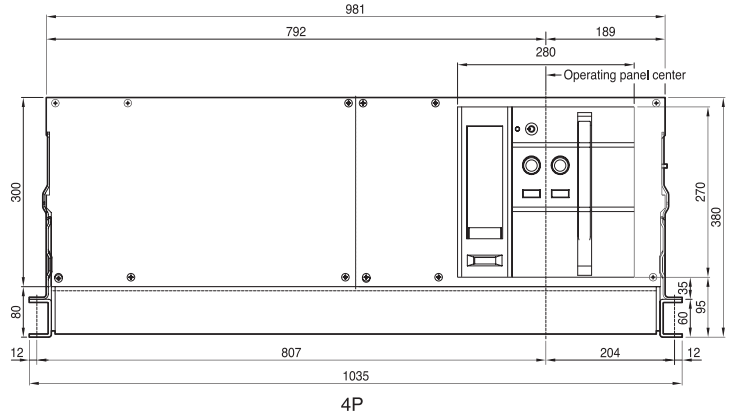


3P

4000A – 5000A

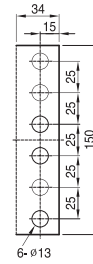


<Conductor>



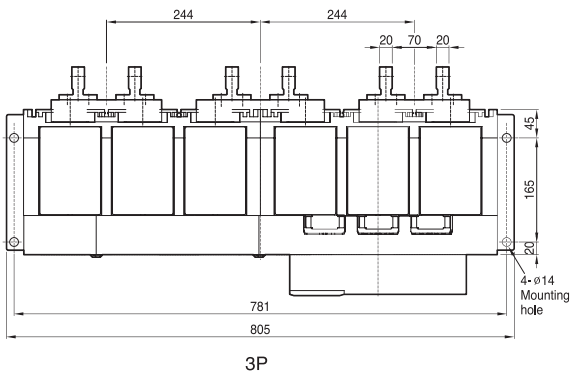
4P

6300A



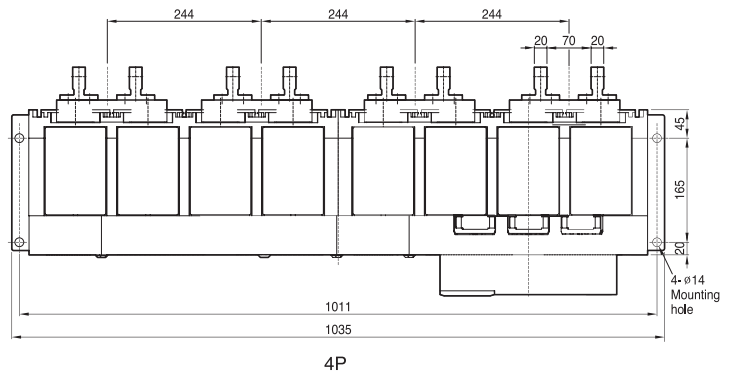
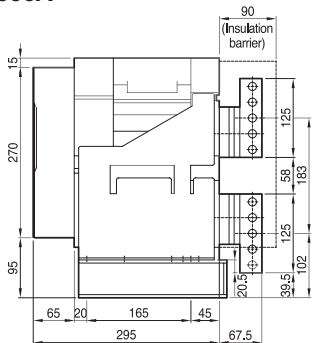
<Conductor>

### Vertical type



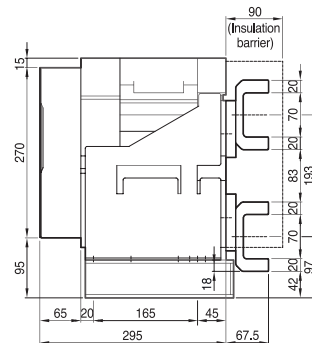
3P

4000A – 5000A



4P

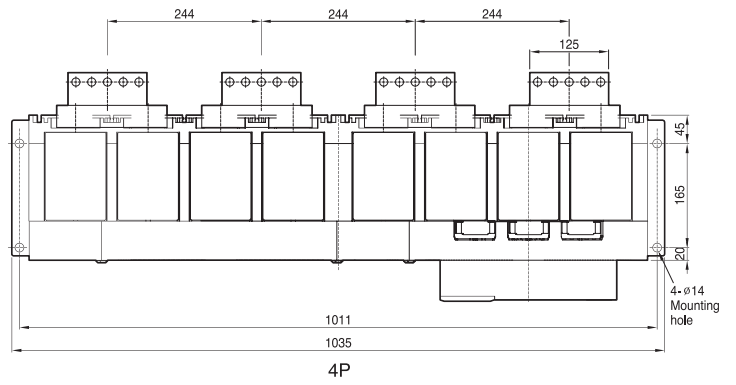
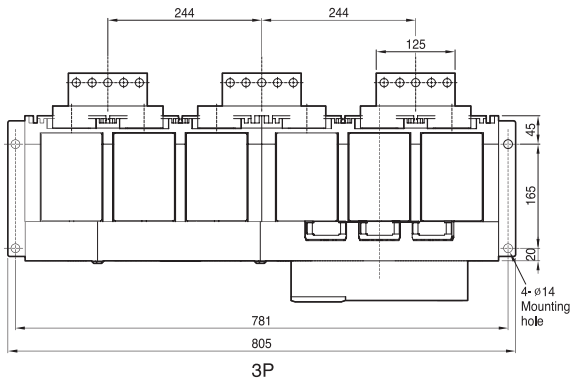
6300A



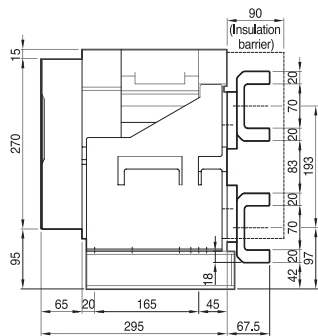
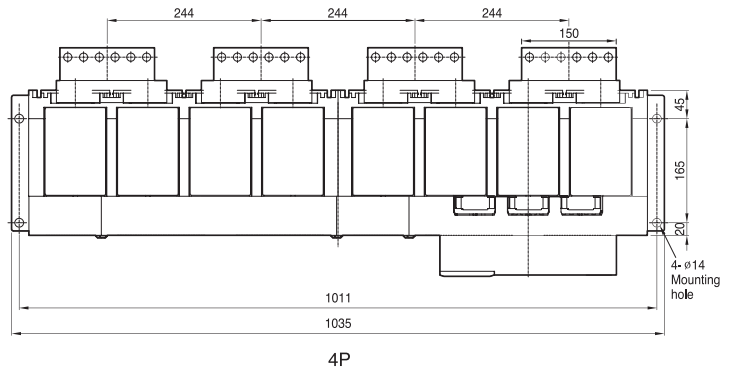
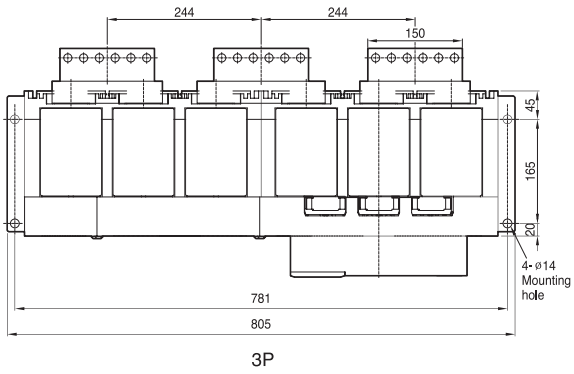


## Horizontal type

### 4000A – 5000A



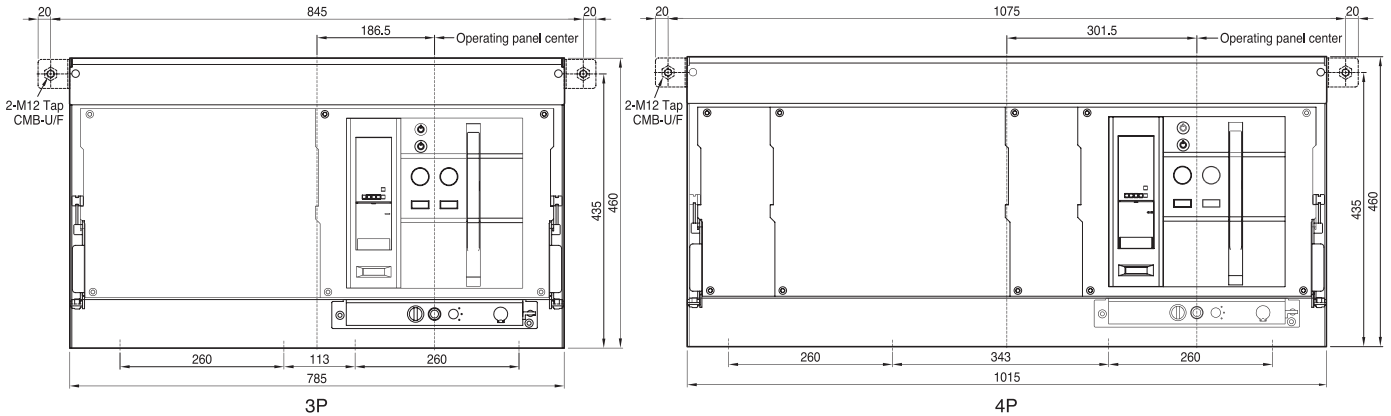
### 6300A



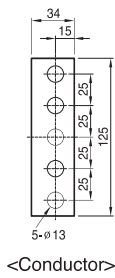
# Dimensions

## Draw-out type 6300AF (4000 – 6300A: AKH / AKS-40 – 50G)

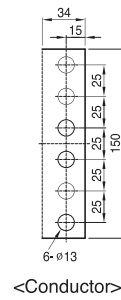
### Front view



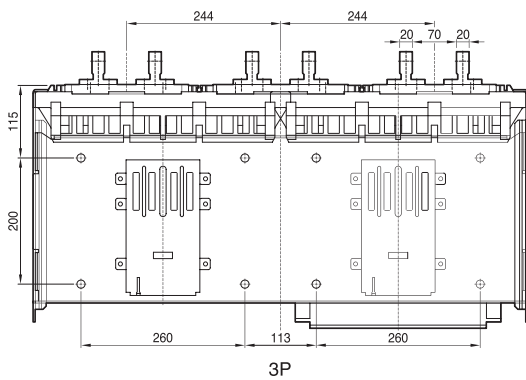
4000A – 5000A



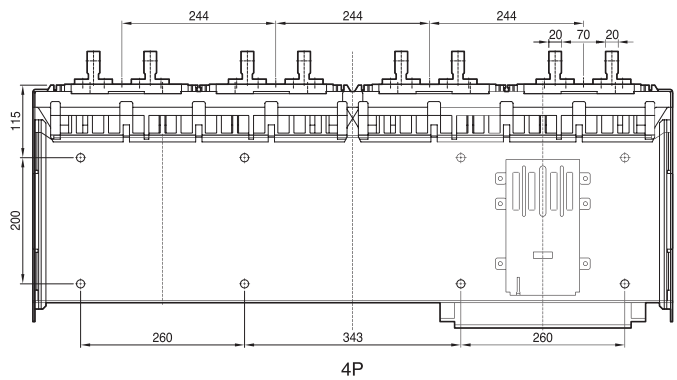
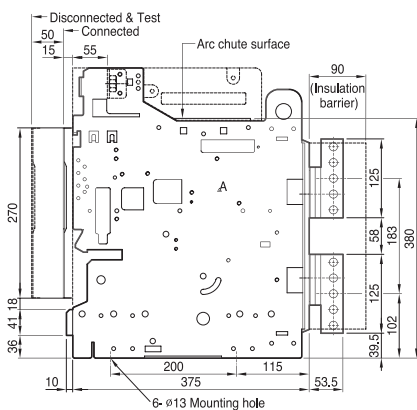
6300A



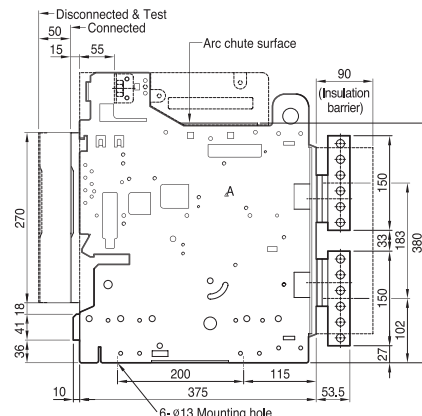
### Vertical type



4000A – 5000A

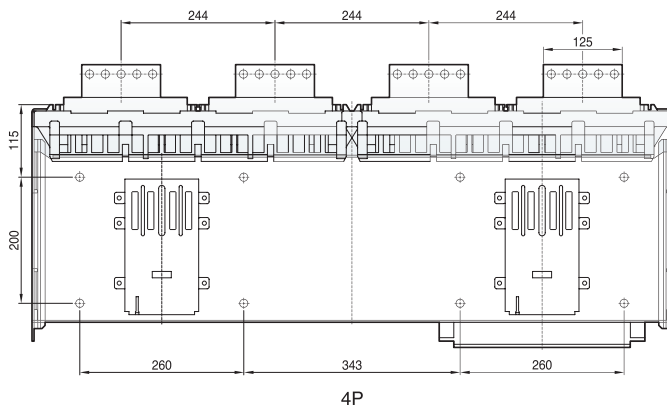
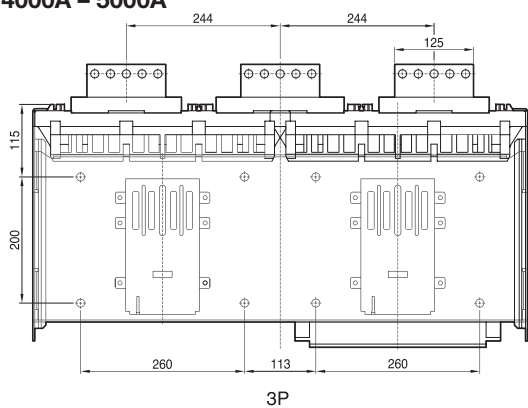


6300A

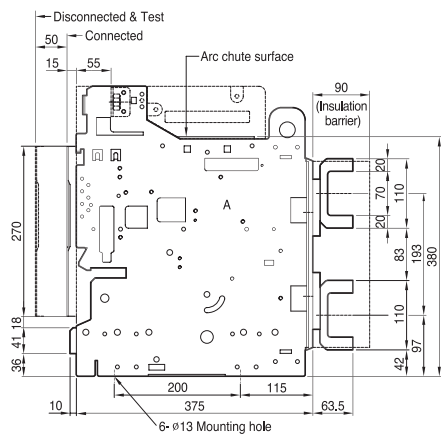
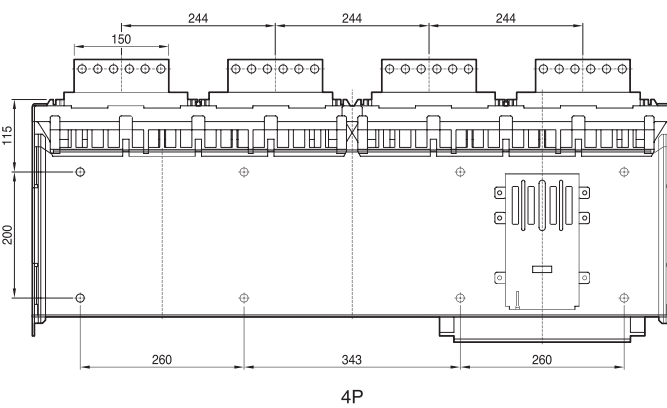
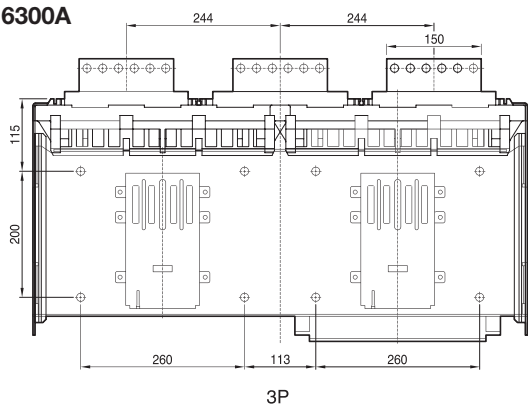


## Horizontal type

### 4000A - 5000A



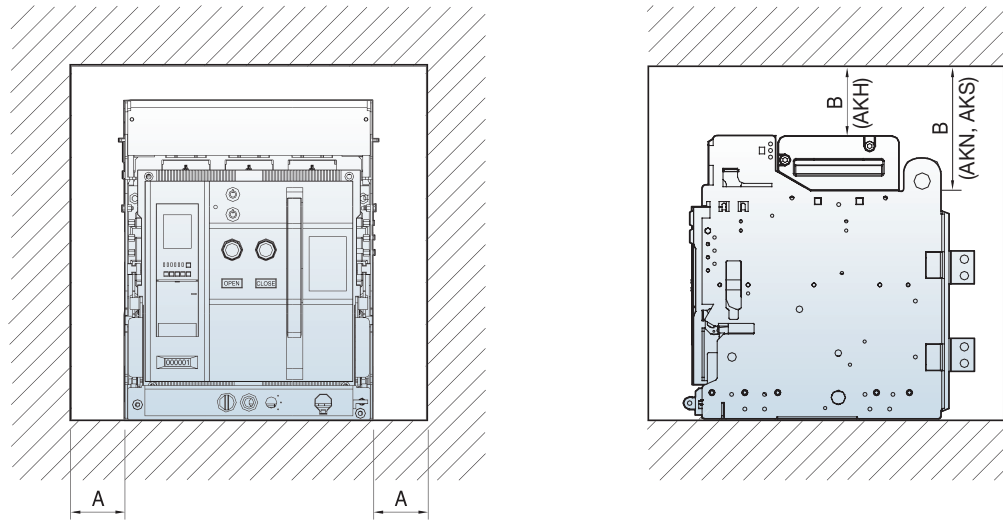
### 6300A



# Technical information

## Insulation voltage

You should keep the isolation distance between ACB and panel as below table.

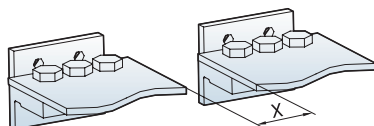


| Type     |         | A  | B   |
|----------|---------|----|-----|
| Fixed    | AKN/AKS | 50 | 150 |
|          | AKH     | 50 | 0   |
| Draw out | AKN/AKS | 50 | 150 |
|          | AKH     | 50 | 0   |

Note) When drawing the distribution panel, it is available to use regardless of the distance between ACB and the wall of the panel because ACB (draw-in/out type) extinguishes the arc in the Arc Chute and Arc Cover cleanly.

## Minimum isolation distance

For the safety, all the electric charging parts need to be installed over minimum isolation distance.



| Insulating voltage (Ui) | Minimum isolation distance (X min) |
|-------------------------|------------------------------------|
| 600V                    | 8 mm                               |
| 1000V                   | 14 mm                              |

## Temperature derating

The table below indicates the maximum current rating, for each connection type, as a function of the ambient temperature around the circuit breaker and the busbars. Circuit breakers with mixed connections have the same derating as horizontally connected breakers. For ambient temperatures greater than 60°C, consult us. Temperature inside the switchboard around the circuit breaker and its connection: T<sub>i</sub> (IEC 60947-2)

| Frame                             | Rated current            | ACB terminal    | Applicable busbar size |  |                 |       |       |       |  |       |       |       |       |       |
|-----------------------------------|--------------------------|-----------------|------------------------|---|-----------------|-------|-------|-------|---|-------|-------|-------|-------|-------|
|                                   |                          |                 |                        | Horizontal type   |                 |       |       |       | Vertical type   |       |       |       |       |       |
|                                   |                          |                 |                        | 40°C  | 45°C            | 50°C  | 55°C  | 60°C  | 40°C  | 45°C  | 50°C  | 55°C  | 60°C  |       |
| 2000AF<br>AKH-D<br>AKS-D<br>AKN-D | 200A                     | 15t x 30 x 1ea  | 5t x 30 x 2ea          | 200A  | 200A            | 200A  | 200A  | 200A  | 200A  | 200A  | 200A  | 200A  | 200A  |       |
|                                   | 400A                     |                 |                        | 400A  | 400A            | 400A  | 400A  | 400A  | 400A  | 400A  | 400A  | 400A  | 400A  |       |
|                                   | 630A                     |                 | 15t x 30 x 1ea         | 5t x 40 x 2ea   | 630A            | 630A  | 630A  | 630A  | 630A  | 630A  | 630A  | 630A  | 630A  | 630A  |
|                                   | 800A                     |                 |                        | 5t x 50 x 2ea   | 800A            | 800A  | 800A  | 800A  | 800A  | 800A  | 800A  | 800A  | 800A  | 800A  |
|                                   | 1000A                    |                 |                        | 5t x 60 x 2ea   | 1000A           | 1000A | 1000A | 1000A | 1000A   | 1000A | 1000A | 1000A | 1000A | 1000A |
|                                   | 1250A                    |                 |                        | 5t x 80 x 2ea   | 1250A           | 1250A | 1250A | 1250A | 1250A   | 1250A | 1250A | 1250A | 1250A | 1250A |
|                                   | 1600A                    |                 |                        | 5t x 100 x 2ea  | 1600A           | 1600A | 1600A | 1550A | 1550A   | 1600A | 1600A | 1600A | 1600A | 1550A |
|                                   | 2000A                    | 15t x 75 x 1ea  | 5t x 100 x 3ea         | -   | -               | -     | -     | -     | 2000A   | 2000A | 2000A | 1950A | 1900A |       |
| 4000AF<br>AKH-E<br>AKS-E          | 630A                     | 20t x 75 x 1ea  | 5t x 40 x 2ea          | 630A  | 630A            | 630A  | 630A  | 630A  | 630A  | 630A  | 630A  | 630A  | 630A  |       |
|                                   | 800A                     |                 | 5t x 50 x 2ea          | 800A  | 800A            | 800A  | 800A  | 800A  | 800A  | 800A  | 800A  | 800A  | 800A  |       |
|                                   | 1000A                    |                 | 5t x 60 x 2ea          | 1000A   | 1000A           | 1000A | 1000A | 1000A | 1000A   | 1000A | 1000A | 1000A | 1000A |       |
|                                   | 1250A                    |                 | 5t x 80 x 2ea          | 1250A   | 1250A           | 1250A | 1250A | 1250A | 1250A   | 1250A | 1250A | 1250A | 1250A |       |
|                                   | 1600A                    |                 | 5t x 100 x 2ea         | 1600A   | 1600A           | 1600A | 1600A | 1600A | 1600A   | 1600A | 1600A | 1600A | 1600A |       |
|                                   | 2000A                    |                 | 5t x 100 x 3ea         | 2000A   | 2000A           | 2000A | 2000A | 2000A | 2000A   | 2000A | 2000A | 2000A | 2000A |       |
|                                   | 2500A                    |                 | 5t x 100 x 4ea         | 2500A   | 2500A           | 2500A | 2400A | 2300A | 2500A   | 2500A | 2500A | 2500A | 2450A | 2350A |
|                                   | 3200A                    |                 | 10t x 100 x 3ea        | 3200A   | 3200A           | 3100A | 3000A | 2900A | 3200A   | 3200A | 3150A | 3050A | 2950A |       |
|                                   | 4000A                    | 10t x 100 x 3ea | 10t x 125 x 3ea        | -   | -               | -     | -     | -     | 4000A   | 4000A | 3950A | 3900A | 3850A |       |
| 5000AF<br>AKS-F                   | 4000A                    | 20t x 125 x 2ea | 10t x 100 x 4ea        | 4000A   | 4000A           | 3900A | 3750A | 3600A | 4000A   | 4000A | 3900A | 3800A | 3700A |       |
|                                   | 5000A                    |                 | 10t x 125 x 4ea        | 5000A   | 5000A           | 4900A | 4800A | 4700A | 5000A   | 5000A | 4950A | 4850A | 4750A |       |
|                                   | 6300AF<br>AKH-G<br>AKS-G |                 | 4000A                  | 20t x 125 x 2ea   | 10t x 100 x 4ea | 4000A | 4000A | 4000A | 3900A   | 3800A | 4000A | 4000A | 3950A | 3850A |
| 5000A                             | 20t x 150 x 2ea          | 10t x 125 x 4ea | 5000A                  | 5000A   | 5000A           | 4900A | 4800A | 5000A | 5000A   | 5000A | 4950A | 4850A |       |       |
| 6300A                             |                          | 10t x 150 x 4ea | 6300A                  | 6300A   | 6200A           | 6100A | 6000A | 6300A | 6300A   | 6250A | 6152A | 6050A |       |       |

# Technical information

## Operating condigions

### Ambient temperature

ACB devices can operate under the following temperature conditions

- The electrical and mechanical characteristics are stipulated for an ambient temperature of -5°C to +40°C
- The average temperature should be within +35°C
- Reduce the continuous conducting current when the temperature is over 45°C (refer to temperature derating)
- Storage condition: -20°C to +60°C is recommended.

### Altitude

ACB is designed for operation at altitudes under 2000m. At altitudes higher than 2000m, emitting heat is lowered and operating voltage, continuous current capacity, and breaking capacity will be reduced. Durability of the insulation is also reduced according to the atmosphere pressure. According to the below table, change the ratings upon a service condition.

| Item \ Altitude [m]           | 2000m  | 3000m     | 4000m     | 5000m     |
|-------------------------------|--------|-----------|-----------|-----------|
| Withstand voltage [V]         | 3500   | 3150      | 2500      | 2100      |
| Average insulating voltage[V] | 1000   | 900       | 700       | 600       |
| Max. using voltage [V]        | 690    | 590       | 520       | 460       |
| Current compensation constant | 1 x In | 0.99 x In | 0.96 x In | 0.94 x In |

### Environment

Under clea air;

Maximum temperature +40°C (relative humidity should be under 85%)

Maximum temperature +20°C (relative humidity should be under 90%)

Do not apply under corrosive or ammmonia gas circumstances

(H<sub>2</sub>S ≤ 0.01ppm, SO<sub>2</sub> ≤ 0.01ppm, NH<sub>3</sub> ≤ a few ppm)

#### \*Extreme atmosphere conditions

Under high temperature and/or high humidity, the insulatin durability, electrical and mechanical features could be deteriorated. At this conditions, increasing corrosion-resistant dealing needs.

Corrosion- resistant parts need under this conditions.

# Time chart

## Long time

| x \ tr | 0.5   | 1      | 2      | 4      | 8      | 12      | 16      | 20      |
|--------|-------|--------|--------|--------|--------|---------|---------|---------|
| 1.11   | 58806 | 117611 | 235223 | 470445 | 940890 | 1411335 | 1881780 | 2352225 |
| 1.15   | 36041 | 72082  | 144163 | 288326 | 576652 | 864978  | 1153305 | 1441631 |
| 1.20   | 26827 | 53654  | 107308 | 214615 | 429231 | 643846  | 858461  | 1073077 |
| 1.25   | 21777 | 43553  | 87106  | 174212 | 348424 | 522636  | 696848  | 871060  |
| 1.30   | 18408 | 36817  | 73634  | 147268 | 294535 | 441803  | 589071  | 736338  |
| 1.35   | 15497 | 31895  | 63789  | 127579 | 255157 | 382736  | 510314  | 637893  |
| 1.40   | 14049 | 28098  | 56197  | 112393 | 224787 | 337180  | 449573  | 561967  |
| 1.45   | 12532 | 25063  | 50126  | 100252 | 200504 | 300756  | 401009  | 501261  |
| 1.50   | 11268 | 22573  | 45145  | 90290  | 180580 | 270870  | 361160  | 451450  |
| 1.55   | 10244 | 20488  | 40977  | 81954  | 163907 | 245861  | 327814  | 409768  |
| 1.60   | 9359  | 18717  | 37434  | 74869  | 149737 | 224606  | 299474  | 374343  |
| 1.65   | 8596  | 17193  | 34386  | 68771  | 137542 | 206313  | 275084  | 343855  |
| 1.70   | 7934  | 15867  | 31734  | 63468  | 126936 | 190404  | 253873  | 317341  |
| 1.75   | 7352  | 14704  | 29408  | 58815  | 117631 | 176446  | 235261  | 294077  |
| 1.80   | 6838  | 13675  | 27351  | 54702  | 109404 | 164106  | 218808  | 273509  |
| 1.85   | 6380  | 12760  | 25521  | 51041  | 102082 | 153123  | 204164  | 255205  |
| 1.90   | 5970  | 11941  | 23882  | 47764  | 95528  | 143292  | 191056  | 238820  |
| 1.95   | 5602  | 11204  | 22408  | 44815  | 89630  | 134446  | 179261  | 224076  |
| 2.00   | 5269  | 10537  | 21075  | 42150  | 84299  | 126449  | 168598  | 210748  |
| 2.05   | 4966  | 9932   | 19865  | 39730  | 79459  | 119189  | 158919  | 198649  |
| 2.10   | 4691  | 9381   | 18762  | 37525  | 75049  | 112574  | 150099  | 187623  |
| 2.15   | 4439  | 8877   | 17754  | 35508  | 71017  | 106525  | 142034  | 177542  |
| 2.20   | 4207  | 8415   | 16829  | 33659  | 67318  | 100976  | 134635  | 168294  |
| 2.25   | 3995  | 7989   | 15979  | 31957  | 63914  | 95871   | 127829  | 159786  |
| 2.30   | 3798  | 7597   | 15194  | 30387  | 60775  | 91162   | 121550  | 151937  |
| 2.35   | 3617  | 7234   | 14468  | 28936  | 57871  | 86807   | 115742  | 144678  |
| 2.40   | 3449  | 6897   | 13795  | 27590  | 55180  | 82769   | 110359  | 137949  |
| 2.45   | 3292  | 6585   | 13170  | 26339  | 52679  | 79018   | 105358  | 131697  |
| 2.50   | 3147  | 6294   | 12588  | 25176  | 50351  | 75527   | 100702  | 125878  |
| 2.55   | 3011  | 6022   | 12045  | 24090  | 48180  | 72269   | 96359   | 120449  |
| 2.60   | 2884  | 5769   | 11538  | 23075  | 46151  | 69226   | 92301   | 115377  |
| 2.65   | 2766  | 5531   | 11063  | 22126  | 44251  | 66377   | 88503   | 110628  |
| 2.70   | 2654  | 5309   | 10618  | 21235  | 42471  | 63706   | 84941   | 106177  |
| 2.75   | 2550  | 5100   | 10200  | 20399  | 40799  | 61198   | 81597   | 101997  |
| 2.80   | 2452  | 4903   | 9807   | 19613  | 39226  | 58840   | 78453   | 98066   |
| 2.85   | 2359  | 4718   | 9436   | 18873  | 37746  | 56619   | 75791   | 94364   |
| 2.90   | 2272  | 4544   | 9087   | 18175  | 36350  | 54524   | 72699   | 90874   |
| 2.95   | 2189  | 4379   | 8758   | 17516  | 35032  | 52547   | 70063   | 87579   |
| 3.00   | 2112  | 4223   | 8446   | 16893  | 33786  | 50679   | 67572   | 84464   |
| 3.05   | 2038  | 4076   | 8152   | 16303  | 32607  | 48910   | 65214   | 81517   |
| 3.10   | 1968  | 3936   | 7872   | 15745  | 31490  | 47235   | 62980   | 78725   |
| 3.15   | 1902  | 3804   | 7608   | 15215  | 30431  | 45646   | 60862   | 76077   |
| 3.20   | 1839  | 3678   | 7356   | 14713  | 29425  | 44138   | 58851   | 73563   |
| 3.25   | 1779  | 3559   | 7117   | 14235  | 28470  | 42705   | 56940   | 71175   |
| 3.30   | 1723  | 3445   | 6890   | 13781  | 27561  | 41342   | 55122   | 68903   |
| 3.35   | 1669  | 3337   | 6674   | 13348  | 26696  | 40044   | 53392   | 66741   |
| 3.40   | 1617  | 3234   | 6468   | 12936  | 25872  | 38808   | 51744   | 64680   |
| 3.45   | 1568  | 3136   | 6272   | 12543  | 25086  | 37629   | 50172   | 62715   |
| 3.50   | 1521  | 3042   | 6084   | 12168  | 24336  | 36504   | 48672   | 60841   |
| 3.55   | 1476  | 2952   | 5905   | 11810  | 23620  | 35430   | 47240   | 59050   |
| 3.60   | 1433  | 2867   | 5734   | 11468  | 22935  | 34403   | 45871   | 57338   |
| 3.65   | 1393  | 2785   | 5570   | 11140  | 22281  | 33421   | 44561   | 55702   |
| 3.70   | 1353  | 2707   | 5413   | 10827  | 21654  | 32481   | 43308   | 54135   |
| 3.75   | 1316  | 2632   | 5263   | 10527  | 21054  | 31581   | 42108   | 52634   |
| 3.80   | 1280  | 2560   | 5120   | 10239  | 20479  | 30718   | 40957   | 51196   |
| 3.85   | 1245  | 2491   | 4982   | 9963   | 19927  | 29890   | 39854   | 49817   |
| 3.90   | 1212  | 2425   | 4849   | 9699   | 19398  | 29096   | 38795   | 48494   |

| x \ tr | 0.5  | 1    | 2    | 4    | 8     | 12    | 16    | 20    |
|--------|------|------|------|------|-------|-------|-------|-------|
| 3.95   | 1181 | 2361 | 4722 | 9445 | 18889 | 28334 | 37779 | 47223 |
| 4.00   | 1150 | 2300 | 4600 | 9201 | 18401 | 27602 | 36802 | 46003 |
| 4.05   | 1121 | 2241 | 4483 | 8966 | 17932 | 26898 | 35864 | 44830 |
| 4.10   | 1093 | 2185 | 4370 | 8740 | 17481 | 26221 | 34961 | 43701 |
| 4.15   | 1065 | 2131 | 4262 | 8523 | 17046 | 25569 | 34092 | 42615 |
| 4.20   | 1039 | 2079 | 4157 | 8314 | 16628 | 24942 | 33256 | 41570 |
| 4.25   | 1014 | 2028 | 4056 | 8113 | 16225 | 24338 | 32451 | 40563 |
| 4.30   | 990  | 1980 | 3959 | 7919 | 15837 | 23756 | 31674 | 39593 |
| 4.35   | 966  | 1933 | 3866 | 7731 | 15463 | 23194 | 30926 | 38657 |
| 4.40   | 944  | 1888 | 3776 | 7551 | 15102 | 22653 | 30204 | 37755 |
| 4.45   | 922  | 1844 | 3688 | 7377 | 14754 | 22131 | 29507 | 36884 |
| 4.50   | 901  | 1802 | 3604 | 7209 | 14417 | 21626 | 28835 | 36043 |
| 4.55   | 881  | 1762 | 3523 | 7046 | 14093 | 21139 | 28185 | 35231 |
| 4.60   | 861  | 1722 | 3445 | 6889 | 13779 | 20668 | 27557 | 34447 |
| 4.65   | 842  | 1684 | 3369 | 6738 | 13475 | 20213 | 26951 | 33688 |
| 4.70   | 824  | 1648 | 3295 | 6591 | 13182 | 19773 | 26364 | 32955 |
| 4.75   | 806  | 1612 | 3225 | 6449 | 12898 | 19347 | 25796 | 32245 |
| 4.80   | 789  | 1578 | 3156 | 6312 | 12624 | 18935 | 25247 | 31559 |
| 4.85   | 772  | 1545 | 3089 | 6179 | 12358 | 18536 | 24715 | 30894 |
| 4.90   | 756  | 1513 | 3025 | 6050 | 12100 | 18150 | 24200 | 30250 |
| 4.95   | 741  | 1481 | 2963 | 5925 | 11851 | 17776 | 23701 | 29627 |
| 5.00   | 726  | 1451 | 2902 | 5804 | 11609 | 17413 | 23218 | 29022 |
| 5.05   | 711  | 1422 | 2844 | 5687 | 11374 | 17062 | 22749 | 28436 |
| 5.10   | 697  | 1393 | 2787 | 5574 | 11147 | 16721 | 22294 | 27868 |
| 5.15   | 683  | 1366 | 2732 | 5463 | 10927 | 16390 | 21853 | 27317 |
| 5.20   | 670  | 1339 | 2678 | 5356 | 10713 | 16069 | 21425 | 26782 |
| 5.25   | 657  | 1313 | 2626 | 5252 | 10505 | 15757 | 21010 | 26262 |
| 5.30   | 644  | 1288 | 2576 | 5152 | 10303 | 15455 | 20607 | 25758 |
| 5.35   | 632  | 1263 | 2527 | 5054 | 10107 | 15161 | 20215 | 25268 |
| 5.40   | 620  | 1240 | 2479 | 4959 | 9917  | 14876 | 19834 | 24793 |
| 5.45   | 608  | 1217 | 2433 | 4866 | 9732  | 14598 | 19464 | 24330 |
| 5.50   | 597  | 1194 | 2388 | 4776 | 9552  | 14329 | 19105 | 23881 |
| 5.55   | 586  | 1172 | 2344 | 4689 | 9378  | 14066 | 18755 | 23444 |
| 5.60   | 575  | 1151 | 2302 | 4604 | 9207  | 13811 | 18415 | 23019 |
| 5.65   | 565  | 1130 | 2261 | 4521 | 9042  | 13563 | 18084 | 22605 |
| 5.70   | 555  | 1110 | 2220 | 4441 | 8881  | 13322 | 17762 | 22203 |
| 5.75   | 545  | 1091 | 2181 | 4362 | 8724  | 13087 | 17449 | 21811 |
| 5.80   | 536  | 1071 | 2143 | 4286 | 8572  | 12858 | 17144 | 21430 |
| 5.85   | 526  | 1053 | 2106 | 4212 | 8423  | 12635 | 16847 | 21058 |
| 5.90   | 517  | 1035 | 2070 | 4139 | 8279  | 12418 | 16557 | 20697 |
| 5.95   | 509  | 1017 | 2034 | 4069 | 8138  | 12206 | 16275 | 20344 |
| 6.00   | 500  | 1000 | 2000 | 4000 | 8000  | 12000 | 16000 | 20001 |
| 6.05   | 492  | 983  | 1967 | 3933 | 7866  | 11799 | 15733 | 19666 |
| 6.10   | 483  | 967  | 1934 | 3868 | 7736  | 11604 | 15471 | 19339 |
| 6.15   | 476  | 951  | 1902 | 3804 | 7608  | 11413 | 15217 | 19021 |
| 6.20   | 468  | 936  | 1871 | 3742 | 7484  | 11226 | 14968 | 18710 |
| 6.25   | 460  | 920  | 1841 | 3682 | 7363  | 11045 | 14726 | 18408 |
| 6.30   | 453  | 906  | 1811 | 3622 | 7245  | 10867 | 14490 | 18112 |
| 6.35   | 446  | 891  | 1782 | 3565 | 7129  | 10694 | 14259 | 17823 |
| 6.40   | 439  | 877  | 1754 | 3508 | 7017  | 10525 | 14034 | 17542 |
| 6.45   | 432  | 863  | 1727 | 3453 | 6907  | 10360 | 13814 | 17267 |
| 6.50   | 425  | 850  | 1700 | 3400 | 6799  | 10199 | 13599 | 16998 |
| 6.55   | 418  | 837  | 1674 | 3347 | 6694  | 10042 | 13389 | 16736 |
| 6.60   | 412  | 824  | 1648 | 3296 | 6592  | 9888  | 13184 | 16480 |
| 6.65   | 406  | 811  | 1623 | 3246 | 6492  | 9738  | 12984 | 16230 |
| 6.70   | 400  | 799  | 1598 | 3197 | 6394  | 9591  | 12788 | 15985 |
| 6.75   | 394  | 787  | 1575 | 3149 | 6298  | 9447  | 12597 | 15746 |

# Time chart

## Long time

| x lr \ tr | 0.5 | 1   | 2    | 4    | 8    | 12   | 16    | 20    |
|-----------|-----|-----|------|------|------|------|-------|-------|
| 6.80      | 388 | 776 | 1551 | 3102 | 6205 | 9307 | 12410 | 15512 |
| 6.85      | 382 | 764 | 1528 | 3057 | 6113 | 9170 | 12227 | 15283 |
| 6.90      | 376 | 753 | 1506 | 3012 | 6024 | 9036 | 12048 | 15060 |
| 6.95      | 371 | 742 | 1484 | 2968 | 5936 | 8905 | 11873 | 14841 |
| 7.00      | 366 | 731 | 1463 | 2925 | 5851 | 8776 | 11702 | 14627 |
| 7.05      | 360 | 721 | 1442 | 2884 | 5767 | 8651 | 11534 | 14418 |
| 7.10      | 355 | 711 | 1421 | 2843 | 5685 | 8528 | 11371 | 14213 |
| 7.15      | 350 | 701 | 1401 | 2803 | 5605 | 8408 | 11210 | 14013 |
| 7.20      | 345 | 691 | 1382 | 2763 | 5527 | 8290 | 11053 | 13816 |
| 7.25      | 341 | 681 | 1362 | 2725 | 5450 | 8175 | 10899 | 13624 |
| 7.30      | 336 | 672 | 1344 | 2687 | 5374 | 8062 | 10749 | 13436 |
| 7.35      | 331 | 663 | 1325 | 2650 | 5301 | 7951 | 10601 | 13252 |
| 7.40      | 327 | 654 | 1307 | 2614 | 5229 | 7843 | 10457 | 13071 |
| 7.45      | 322 | 645 | 1289 | 2579 | 5158 | 7737 | 10316 | 12895 |
| 7.50      | 318 | 636 | 1272 | 2544 | 5089 | 7633 | 10177 | 12721 |
| 7.55      | 314 | 628 | 1255 | 2510 | 5021 | 7531 | 10041 | 12552 |
| 7.60      | 310 | 619 | 1239 | 2477 | 4954 | 7431 | 9908  | 12385 |
| 7.65      | 306 | 611 | 1222 | 2444 | 4889 | 7333 | 9778  | 12222 |
| 7.70      | 302 | 603 | 1206 | 2412 | 4825 | 7237 | 9650  | 12062 |
| 7.75      | 298 | 595 | 1191 | 2381 | 4762 | 7143 | 9524  | 11906 |
| 7.80      | 294 | 588 | 1175 | 2350 | 4701 | 7051 | 9401  | 11752 |
| 7.85      | 290 | 580 | 1160 | 2320 | 4640 | 6961 | 9281  | 11601 |
| 7.90      | 286 | 573 | 1145 | 2291 | 4581 | 6872 | 9163  | 11453 |
| 7.95      | 283 | 565 | 1131 | 2262 | 4523 | 6785 | 9047  | 11308 |
| 8.00      | 279 | 558 | 1117 | 2233 | 4466 | 6700 | 8933  | 11166 |
| 8.05      | 276 | 551 | 1103 | 2205 | 4411 | 6616 | 8821  | 11026 |
| 8.10      | 272 | 544 | 1089 | 2178 | 4356 | 6534 | 8712  | 10889 |
| 8.15      | 269 | 538 | 1076 | 2151 | 4302 | 6453 | 8604  | 10755 |
| 8.20      | 266 | 531 | 1062 | 2125 | 4249 | 6374 | 8498  | 10623 |
| 8.25      | 262 | 525 | 1049 | 2099 | 4197 | 6296 | 8395  | 10494 |
| 8.30      | 259 | 518 | 1037 | 2073 | 4147 | 6220 | 8293  | 10366 |
| 8.35      | 256 | 512 | 1024 | 2048 | 4097 | 6145 | 8193  | 10242 |
| 8.40      | 253 | 506 | 1012 | 2024 | 4048 | 6071 | 8095  | 10119 |
| 8.45      | 250 | 500 | 1000 | 2000 | 3999 | 5999 | 7999  | 9998  |
| 8.50      | 247 | 494 | 988  | 1976 | 3952 | 5928 | 7904  | 9880  |
| 8.55      | 244 | 488 | 976  | 1953 | 3906 | 5858 | 7811  | 9764  |
| 8.60      | 241 | 482 | 965  | 1930 | 3860 | 5790 | 7720  | 9650  |
| 8.65      | 238 | 477 | 954  | 1908 | 3815 | 5723 | 7630  | 9538  |
| 8.70      | 236 | 471 | 943  | 1886 | 3771 | 5657 | 7542  | 9428  |
| 8.75      | 233 | 466 | 932  | 1864 | 3728 | 5592 | 7455  | 9319  |
| 8.80      | 230 | 461 | 921  | 1843 | 3685 | 5528 | 7370  | 9213  |
| 8.85      | 228 | 455 | 911  | 1822 | 3643 | 5465 | 7287  | 9108  |
| 8.90      | 225 | 450 | 901  | 1801 | 3602 | 5403 | 7204  | 9005  |
| 8.95      | 223 | 445 | 890  | 1781 | 3562 | 5343 | 7123  | 8904  |
| 9.00      | 220 | 440 | 880  | 1761 | 3522 | 5283 | 7044  | 8805  |
| 9.05      | 218 | 435 | 871  | 1741 | 3483 | 5224 | 6966  | 8707  |
| 9.10      | 215 | 431 | 861  | 1722 | 3444 | 5167 | 6889  | 8611  |
| 9.15      | 213 | 426 | 852  | 1703 | 3407 | 5110 | 6813  | 8516  |
| 9.20      | 211 | 421 | 842  | 1685 | 3369 | 5054 | 6739  | 8423  |
| 9.25      | 208 | 417 | 833  | 1666 | 3333 | 4999 | 6666  | 8332  |
| 9.30      | 206 | 412 | 824  | 1648 | 3297 | 4945 | 6594  | 8242  |
| 9.35      | 204 | 408 | 815  | 1631 | 3261 | 4892 | 6523  | 8153  |
| 9.40      | 202 | 403 | 807  | 1613 | 3227 | 4840 | 6453  | 8066  |
| 9.45      | 200 | 399 | 798  | 1596 | 3192 | 4788 | 6384  | 7981  |
| 9.50      | 197 | 395 | 790  | 1579 | 3159 | 4738 | 6317  | 7896  |
| 9.55      | 195 | 391 | 781  | 1563 | 3125 | 4688 | 6251  | 7813  |
| 9.60      | 193 | 387 | 773  | 1546 | 3093 | 4639 | 6185  | 7732  |

| x lr \ tr | 0.5 | 1   | 2   | 4    | 8    | 12   | 16   | 20   |
|-----------|-----|-----|-----|------|------|------|------|------|
| 9.65      | 191 | 383 | 765 | 1530 | 3060 | 4591 | 6121 | 7651 |
| 9.70      | 189 | 379 | 757 | 1514 | 3029 | 4543 | 6058 | 7572 |
| 9.75      | 187 | 375 | 749 | 1499 | 2998 | 4496 | 5995 | 7494 |
| 9.80      | 185 | 371 | 742 | 1483 | 2967 | 4450 | 5934 | 7417 |
| 9.85      | 184 | 367 | 734 | 1468 | 2937 | 4405 | 5873 | 7342 |
| 9.90      | 182 | 363 | 727 | 1453 | 2907 | 4360 | 5814 | 7267 |
| 9.95      | 180 | 360 | 719 | 1439 | 2878 | 4316 | 5755 | 7194 |
| 10.00     | 178 | 356 | 712 | 1424 | 2849 | 4273 | 5697 | 7122 |

## Short time

| x lr \ tsd | 0.1  | 0.2   | 0.3   | 0.4   | x lr \ tsd | 0.1 | 0.2  | 0.3  | 0.4  |
|------------|------|-------|-------|-------|------------|-----|------|------|------|
| 1.40       | 5102 | 10204 | 15306 | 20408 | 3.40       | 865 | 1730 | 2595 | 3460 |
| 1.45       | 4756 | 9512  | 14269 | 19025 | 3.45       | 840 | 1680 | 2520 | 3361 |
| 1.50       | 4444 | 8889  | 13333 | 17778 | 3.50       | 816 | 1633 | 2449 | 3265 |
| 1.55       | 4162 | 8325  | 12487 | 16649 | 3.55       | 793 | 1587 | 2380 | 3174 |
| 1.60       | 3906 | 7813  | 11719 | 15625 | 3.60       | 772 | 1543 | 2315 | 3086 |
| 1.65       | 3673 | 7346  | 11019 | 14692 | 3.65       | 751 | 1501 | 2252 | 3002 |
| 1.70       | 3460 | 6920  | 10381 | 13841 | 3.70       | 730 | 1461 | 2191 | 2922 |
| 1.75       | 3265 | 6531  | 9796  | 13061 | 3.75       | 711 | 1422 | 2133 | 2844 |
| 1.80       | 3086 | 6173  | 9259  | 12346 | 3.80       | 693 | 1385 | 2078 | 2770 |
| 1.85       | 2922 | 5844  | 8766  | 11687 | 3.85       | 675 | 1349 | 2024 | 2699 |
| 1.90       | 2770 | 5540  | 8310  | 11080 | 3.90       | 657 | 1315 | 1972 | 2630 |
| 1.95       | 2630 | 5260  | 7890  | 10519 | 3.95       | 641 | 1282 | 1923 | 2564 |
| 2.00       | 2500 | 5000  | 7500  | 10000 | 4.00       | 625 | 1250 | 1875 | 2500 |
| 2.05       | 2380 | 4759  | 7139  | 9518  | 4.05       | 610 | 1219 | 1829 | 2439 |
| 2.10       | 2268 | 4535  | 6803  | 9070  | 4.10       | 595 | 1190 | 1785 | 2380 |
| 2.15       | 2163 | 4327  | 6490  | 8653  | 4.15       | 581 | 1161 | 1742 | 2323 |
| 2.20       | 2066 | 4132  | 6198  | 8264  | 4.20       | 567 | 1134 | 1701 | 2268 |
| 2.25       | 1975 | 3951  | 5926  | 7901  | 4.25       | 554 | 1107 | 1661 | 2215 |
| 2.30       | 1890 | 3781  | 5671  | 7561  | 4.30       | 541 | 1082 | 1622 | 2163 |
| 2.35       | 1811 | 3622  | 5432  | 7243  | 4.35       | 528 | 1057 | 1585 | 2114 |
| 2.40       | 1736 | 3472  | 5208  | 6944  | 4.40       | 517 | 1033 | 1550 | 2066 |
| 2.45       | 1666 | 3332  | 4998  | 6664  | 4.45       | 505 | 1010 | 1515 | 2020 |
| 2.50       | 1600 | 3200  | 4800  | 6400  | 4.50       | 494 | 988  | 1481 | 1975 |
| 2.55       | 1538 | 3076  | 4614  | 6151  | 4.55       | 483 | 966  | 1449 | 1932 |
| 2.60       | 1479 | 2959  | 4438  | 5917  | 4.60       | 473 | 945  | 1418 | 1890 |
| 2.65       | 1424 | 2848  | 4272  | 5696  | 4.65       | 462 | 925  | 1387 | 1850 |
| 2.70       | 1372 | 2743  | 4115  | 5487  | 4.70       | 453 | 905  | 1358 | 1811 |
| 2.75       | 1322 | 2645  | 3967  | 5289  | 4.75       | 443 | 886  | 1330 | 1773 |
| 2.80       | 1276 | 2551  | 3827  | 5102  | 4.80       | 434 | 868  | 1302 | 1736 |
| 2.85       | 1231 | 2462  | 3693  | 4925  | 4.85       | 425 | 850  | 1275 | 1700 |
| 2.90       | 1189 | 2378  | 3567  | 4756  | 4.90       | 416 | 833  | 1249 | 1666 |
| 2.95       | 1149 | 2298  | 3447  | 4596  | 4.95       | 408 | 816  | 1224 | 1632 |
| 3.00       | 1111 | 2222  | 3333  | 4444  | 5.00       | 400 | 800  | 1200 | 1600 |
| 3.05       | 1075 | 2150  | 3225  | 4300  | 5.05       | 392 | 784  | 1176 | 1568 |
| 3.10       | 1041 | 2081  | 3122  | 4162  | 5.10       | 384 | 769  | 1153 | 1538 |
| 3.15       | 1008 | 2016  | 3023  | 4031  | 5.15       | 377 | 754  | 1131 | 1508 |
| 3.20       | 977  | 1953  | 2930  | 3906  | 5.20       | 370 | 740  | 1109 | 1479 |
| 3.25       | 947  | 1893  | 2840  | 3787  | 5.25       | 363 | 726  | 1088 | 1451 |
| 3.30       | 918  | 1837  | 2755  | 3673  | 5.30       | 356 | 712  | 1068 | 1424 |
| 3.35       | 891  | 1782  | 2673  | 3564  | 5.35       | 349 | 699  | 1048 | 1398 |



### Short time

| x lr \ tsd | 0.1 | 0.2 | 0.3  | 0.4  |
|------------|-----|-----|------|------|
| 5.40       | 343 | 686 | 1029 | 1372 |
| 5.45       | 337 | 673 | 1010 | 1347 |
| 5.50       | 331 | 661 | 992  | 1322 |
| 5.55       | 325 | 649 | 974  | 1299 |
| 5.60       | 319 | 638 | 957  | 1276 |
| 5.65       | 313 | 627 | 940  | 1253 |
| 5.70       | 308 | 616 | 923  | 1231 |
| 5.75       | 302 | 605 | 907  | 1210 |
| 5.80       | 297 | 595 | 892  | 1189 |
| 5.85       | 292 | 584 | 877  | 1169 |
| 5.90       | 287 | 575 | 862  | 1149 |
| 5.95       | 282 | 565 | 847  | 1130 |
| 6.00       | 278 | 556 | 833  | 1111 |
| 6.05       | 273 | 546 | 820  | 1093 |
| 6.10       | 269 | 537 | 806  | 1075 |
| 6.15       | 264 | 529 | 793  | 1058 |
| 6.20       | 260 | 520 | 780  | 1041 |
| 6.25       | 256 | 512 | 768  | 1024 |
| 6.30       | 252 | 504 | 756  | 1008 |
| 6.35       | 248 | 496 | 744  | 992  |
| 6.40       | 244 | 488 | 732  | 977  |
| 6.45       | 240 | 481 | 721  | 961  |
| 6.50       | 237 | 473 | 710  | 947  |
| 6.55       | 233 | 466 | 699  | 932  |
| 6.60       | 230 | 459 | 689  | 918  |
| 6.65       | 226 | 452 | 678  | 905  |
| 6.70       | 223 | 446 | 668  | 891  |
| 6.75       | 219 | 439 | 658  | 878  |
| 6.80       | 216 | 433 | 649  | 865  |
| 6.85       | 213 | 426 | 639  | 852  |
| 6.90       | 210 | 420 | 630  | 840  |
| 6.95       | 207 | 414 | 621  | 828  |
| 7.00       | 204 | 408 | 612  | 816  |
| 7.05       | 201 | 402 | 604  | 805  |
| 7.10       | 198 | 397 | 595  | 793  |
| 7.15       | 196 | 391 | 587  | 782  |
| 7.20       | 193 | 386 | 579  | 772  |
| 7.25       | 190 | 380 | 571  | 761  |
| 7.30       | 188 | 375 | 563  | 751  |
| 7.35       | 185 | 370 | 555  | 740  |
| 7.40       | 183 | 365 | 548  | 730  |
| 7.45       | 180 | 360 | 541  | 721  |
| 7.50       | 178 | 356 | 533  | 711  |
| 7.55       | 175 | 351 | 526  | 702  |
| 7.60       | 173 | 346 | 519  | 693  |
| 7.65       | 171 | 342 | 513  | 683  |
| 7.70       | 169 | 337 | 506  | 675  |
| 7.75       | 166 | 333 | 499  | 666  |
| 7.80       | 164 | 329 | 493  | 657  |
| 7.85       | 162 | 325 | 487  | 649  |
| 7.90       | 160 | 320 | 481  | 641  |
| 7.95       | 158 | 316 | 475  | 633  |
| 8.00       | 156 | 312 | 469  | 625  |
| 8.05       | 154 | 309 | 463  | 617  |
| 8.10       | 152 | 305 | 457  | 610  |
| 8.15       | 151 | 301 | 452  | 602  |
| 8.20       | 149 | 297 | 446  | 595  |

### Ground fault

| x lr \ tsd | 0.1 | 0.2 | 0.3 | 0.4 | x lr \ tg | 0.1  | 0.2  | 0.3  | 0.4   | x lr \ tg | 0.1 | 0.2 | 0.3 | 0.4 | x lr \ tg | 0.1 | 0.2 | 0.3 | 0.4 |  |
|------------|-----|-----|-----|-----|-----------|------|------|------|-------|-----------|-----|-----|-----|-----|-----------|-----|-----|-----|-----|--|
| 8.25       | 147 | 294 | 441 | 588 | 0.20      | 2500 | 5000 | 7500 | 10000 | 0.77      | 169 | 337 | 506 | 675 |           |     |     |     |     |  |
| 8.30       | 145 | 290 | 435 | 581 | 0.21      | 2268 | 4535 | 6803 | 9070  | 0.78      | 164 | 329 | 493 | 657 |           |     |     |     |     |  |
| 8.35       | 143 | 287 | 430 | 574 | 0.22      | 2066 | 4132 | 6198 | 8264  | 0.79      | 160 | 320 | 481 | 641 |           |     |     |     |     |  |
| 8.40       | 142 | 283 | 425 | 567 | 0.23      | 1890 | 3781 | 5671 | 7561  | 0.80      | 156 | 313 | 469 | 625 |           |     |     |     |     |  |
| 8.45       | 140 | 280 | 420 | 560 | 0.24      | 1736 | 3472 | 5208 | 6944  | 0.81      | 152 | 305 | 457 | 610 |           |     |     |     |     |  |
| 8.50       | 138 | 277 | 415 | 554 | 0.25      | 1600 | 3200 | 4800 | 6400  | 0.82      | 149 | 297 | 446 | 595 |           |     |     |     |     |  |
| 8.55       | 137 | 274 | 410 | 547 | 0.26      | 1479 | 2959 | 4438 | 5917  | 0.83      | 145 | 290 | 435 | 581 |           |     |     |     |     |  |
| 8.60       | 135 | 270 | 406 | 541 | 0.27      | 1372 | 2743 | 4115 | 5487  | 0.84      | 142 | 283 | 425 | 567 |           |     |     |     |     |  |
| 8.65       | 134 | 267 | 401 | 535 | 0.28      | 1276 | 2551 | 3827 | 5102  | 0.85      | 138 | 277 | 415 | 554 |           |     |     |     |     |  |
| 8.70       | 132 | 264 | 396 | 528 | 0.29      | 1189 | 2378 | 3567 | 4756  | 0.86      | 135 | 270 | 406 | 541 |           |     |     |     |     |  |
| 8.75       | 131 | 261 | 392 | 522 | 0.30      | 1111 | 2222 | 3333 | 4444  | 0.87      | 132 | 264 | 396 | 528 |           |     |     |     |     |  |
| 8.80       | 129 | 258 | 387 | 517 | 0.31      | 1041 | 2081 | 3122 | 4162  | 0.88      | 129 | 258 | 387 | 517 |           |     |     |     |     |  |
| 8.85       | 128 | 255 | 383 | 511 | 0.32      | 977  | 1953 | 2930 | 3906  | 0.89      | 126 | 252 | 379 | 505 |           |     |     |     |     |  |
| 8.90       | 126 | 252 | 379 | 505 | 0.33      | 918  | 1837 | 2755 | 3673  | 0.90      | 123 | 247 | 370 | 494 |           |     |     |     |     |  |
| 8.95       | 125 | 250 | 375 | 499 | 0.34      | 865  | 1730 | 2595 | 3460  | 0.91      | 121 | 242 | 362 | 483 |           |     |     |     |     |  |
| 9.00       | 123 | 247 | 370 | 494 | 0.35      | 816  | 1633 | 2449 | 3265  | 0.92      | 118 | 236 | 354 | 473 |           |     |     |     |     |  |
| 9.05       | 122 | 244 | 366 | 488 | 0.36      | 772  | 1543 | 2315 | 3086  | 0.93      | 116 | 231 | 347 | 462 |           |     |     |     |     |  |
| 9.10       | 121 | 242 | 362 | 483 | 0.37      | 730  | 1461 | 2191 | 2922  | 0.94      | 113 | 226 | 340 | 453 |           |     |     |     |     |  |
| 9.15       | 119 | 239 | 358 | 478 | 0.38      | 693  | 1385 | 2078 | 2770  | 0.95      | 111 | 222 | 332 | 443 |           |     |     |     |     |  |
| 9.20       | 118 | 236 | 354 | 473 | 0.39      | 657  | 1315 | 1972 | 2630  | 0.96      | 109 | 217 | 326 | 434 |           |     |     |     |     |  |
| 9.25       | 117 | 234 | 351 | 467 | 0.40      | 625  | 1250 | 1875 | 2500  | 0.97      | 106 | 213 | 319 | 425 |           |     |     |     |     |  |
| 9.30       | 116 | 231 | 347 | 462 | 0.41      | 595  | 1190 | 1785 | 2380  | 0.98      | 104 | 208 | 312 | 416 |           |     |     |     |     |  |
| 9.35       | 114 | 229 | 343 | 458 | 0.42      | 567  | 1134 | 1701 | 2268  | 0.99      | 102 | 204 | 306 | 408 |           |     |     |     |     |  |
| 9.40       | 113 | 226 | 340 | 453 | 0.43      | 541  | 1082 | 1622 | 2163  | 1.00      | 100 | 200 | 300 | 400 |           |     |     |     |     |  |
| 9.45       | 112 | 224 | 336 | 448 | 0.44      | 517  | 1033 | 1550 | 2066  |           |     |     |     |     |           |     |     |     |     |  |
| 9.50       | 111 | 222 | 332 | 443 | 0.45      | 494  | 988  | 1481 | 1975  |           |     |     |     |     |           |     |     |     |     |  |
| 9.55       | 110 | 219 | 329 | 439 | 0.46      | 473  | 945  | 1418 | 1890  |           |     |     |     |     |           |     |     |     |     |  |
| 9.60       | 109 | 217 | 326 | 434 | 0.47      | 453  | 905  | 1358 | 1811  |           |     |     |     |     |           |     |     |     |     |  |
| 9.65       | 107 | 215 | 322 | 430 | 0.48      | 434  | 868  | 1302 | 1736  |           |     |     |     |     |           |     |     |     |     |  |
| 9.70       | 106 | 213 | 319 | 425 | 0.49      | 416  | 833  | 1249 | 1666  |           |     |     |     |     |           |     |     |     |     |  |
| 9.75       | 105 | 210 | 316 | 421 | 0.50      | 400  | 800  | 1200 | 1600  |           |     |     |     |     |           |     |     |     |     |  |
| 9.80       | 104 | 208 | 312 | 416 | 0.51      | 384  | 769  | 1153 | 1538  |           |     |     |     |     |           |     |     |     |     |  |
| 9.85       | 103 | 206 | 309 | 412 | 0.52      | 370  | 740  | 1109 | 1479  |           |     |     |     |     |           |     |     |     |     |  |
| 9.90       | 102 | 204 | 306 | 408 | 0.53      | 356  | 712  | 1068 | 1424  |           |     |     |     |     |           |     |     |     |     |  |
| 9.95       | 101 | 202 | 303 | 404 | 0.54      | 343  | 686  | 1029 | 1372  |           |     |     |     |     |           |     |     |     |     |  |
| 10.00      | 100 | 200 | 300 | 400 | 0.55      | 331  | 661  | 992  | 1322  |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.56      | 319  | 638  | 957  | 1276  |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.57      | 308  | 616  | 923  | 1231  |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.58      | 297  | 595  | 892  | 1189  |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.59      | 287  | 575  | 862  | 1149  |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.60      | 278  | 556  | 833  | 1111  |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.61      | 269  | 537  | 806  | 1075  |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.62      | 260  | 520  | 780  | 1041  |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.63      | 252  | 504  | 756  | 1008  |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.64      | 244  | 488  | 732  | 977   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.65      | 237  | 473  | 710  | 947   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.66      | 230  | 459  | 689  | 918   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.67      | 223  | 446  | 668  | 891   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.68      | 216  | 433  | 649  | 865   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.69      | 210  | 420  | 630  | 840   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.70      | 204  | 408  | 612  | 816   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.71      | 198  | 397  | 595  | 793   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.72      | 193  | 386  | 579  | 772   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.73      | 188  | 375  | 563  | 751   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.74      | 183  | 365  | 548  | 730   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.75      | 178  | 356  | 533  | 711   |           |     |     |     |     |           |     |     |     |     |  |
|            |     |     |     |     | 0.76      | 173  | 346  | 519  | 693   |           |     |     |     |     |           |     |     |     |     |  |

# Ordering sheet

For faster quote processing, please use the following request for ordering sheet. For each section, check the applicable box or enter value corresponding to your choice.

|                |  |               |           |                  |
|----------------|--|---------------|-----------|------------------|
| Receipt        | Hitachi Industrial Equipment Systems Co., Ltd. | Order date    |           | Distributor name |
| Project        |  | Contractor    |           |                  |
| Delivery place |  | Delivery date | PNL Maker |                  |

| ACB main body  | Type of ACB  | <input type="checkbox"/> AKH  | <input type="checkbox"/> AKN <i>Note 1</i>   | <input type="checkbox"/> AKS                         | Quantity  |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                      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|  | Frame type   | <input type="checkbox"/> D (630 – 2000AF) <i>Note 1</i>   |  | <input type="checkbox"/> E (2000 – 4000AF)           | <input type="checkbox"/> F (4000 – 5000AF)                | <input type="checkbox"/> G (4000 – 6300AF)  |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                    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|  | Ratings  | AF  |  |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |        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|  | Rated current (CT)   | A   |  |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                       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|  | Triple relay   | <input type="checkbox"/> NO<br><input type="checkbox"/> YES   |  |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                         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|  | Type   | Frequency   |  | Control voltage                                      |   | Comm.   |   | Optional function   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |       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|  |  | 60Hz  | 50Hz   | No   | AC/DC 100 – 250V  | DC 24 – 60V   | No  | Yes   | Earth leakage detection                          | External CT ground fault |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |   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|  | N Normal   | <input type="checkbox"/> NG0  | <input type="checkbox"/> NG5   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         | <input type="checkbox"/> |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |             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|  |  | <input type="checkbox"/> AG0  | <input type="checkbox"/> AG5   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         | <input type="checkbox"/> |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                       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| <input type="checkbox"/> AG1                           |  | <input type="checkbox"/> AG6  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          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| <input type="checkbox"/> AG2                           |  | <input type="checkbox"/> AG7  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          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| <input type="checkbox"/> AZ0                           |  | <input type="checkbox"/> AZ5  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          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| <input type="checkbox"/> AZ1                           |  | <input type="checkbox"/> AZ6  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          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| <input type="checkbox"/> AZ2                           |  | <input type="checkbox"/> AZ7  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          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| <input type="checkbox"/> AE0                           |  | <input type="checkbox"/> AE5  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          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| <input type="checkbox"/> AE1                           |  | <input type="checkbox"/> AE6  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          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| <input type="checkbox"/> AE2                           |  | <input type="checkbox"/> AE7  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          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| A Ammeter  | <input type="checkbox"/> AC1   | <input type="checkbox"/> AC6  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |              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|  | <input type="checkbox"/> AC2   | <input type="checkbox"/> AC7  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                        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|  | <input type="checkbox"/> AK1   | <input type="checkbox"/> AK6  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                        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|  | <input type="checkbox"/> AK2   | <input type="checkbox"/> AK7  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                        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|  | <input type="checkbox"/> AX1   | <input type="checkbox"/> AX6  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                        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|  | <input type="checkbox"/> AX2   | <input type="checkbox"/> AX7  | <input type="checkbox"/>   | <input type="checkbox"/>                             | <input type="checkbox"/>                                  | <input type="checkbox"/>  | <input type="checkbox"/>                                    | <input type="checkbox"/>                                    | <input type="checkbox"/>                         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                        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|  | <i>Note 1</i> - Standard function: Ground fault detection<br>- Communication function is not available under no control voltage<br>- AKN, AKS type is not available for S Meter<br>- P (Power), S (Supreme) Meter is also available for generator protection<br>- P, S Meter needs the accessory (VDM) for voltage measurement |   |  |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |     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|  | No. of poles   | <input type="checkbox"/> 3-pole   |  |  | <input type="checkbox"/> 4-pole                           | <input type="checkbox"/> Standard type (R, S, T, N)<br><input type="checkbox"/> Reverse phase type (N, R, S, T)                     |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |      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|  | Installation type  | <input type="checkbox"/> Draw-out type  |  |  |   |   | <input type="checkbox"/> Fixed type                         |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |            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|  | Closing type   | <input type="checkbox"/> Manual closing   |  |  |   |   | <input type="checkbox"/> Electric closing                   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |              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|  | - Charge method: Charging completion contact (1b) is basically installed.<br>- Motor operating voltage   |   |  |  |   | <input type="checkbox"/> Standard type (OFF-Charge method)<br><input type="checkbox"/> Rapid auto-reclosing type (ON-Charge method) |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |    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| Closing voltage  | <input type="checkbox"/> AC/DC 100V – 130V   | <input type="checkbox"/> DC 125V  | <input type="checkbox"/> AC/DC 200V – 250V   | <input type="checkbox"/> DC 125V                     | <input type="checkbox"/> DC 24V – 30V                     | <input type="checkbox"/> DC 48V – 60V   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |              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| Trip voltage   | <input type="checkbox"/> AC/DC 100V – 130V   | <input type="checkbox"/> DC 125V  | <input type="checkbox"/> AC/DC 200V – 250V   | <input type="checkbox"/> DC 24V – 30V                | <input type="checkbox"/> DC 48V – 60V                     | <input type="checkbox"/> AC 380V – 480V<br><input type="checkbox"/> AC 48V  |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |       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| ACB cradle   | Cradle type  | <input type="checkbox"/> No safety shutter (E class)  |  |  |   | <input type="checkbox"/> Safety shutter attachment (F class)  |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                 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|  | Terminal connection  | <input type="checkbox"/> Manual connection  |  |  |   | <input type="checkbox"/> Automatic connection   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                  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|  | Connections  | <input type="checkbox"/> Horizontal   |  | <input type="checkbox"/> Vertical                    | <input type="checkbox"/> Front connection                 |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                        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|  |  | Line: Horizontal, Load: Vertical  |  | Line: Vertical, Load: Horizontal                     | <input type="checkbox"/> Separate order/User installation |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |             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| ACB accessory  | ACB Main body  | Standard accessory  | - Aux. contact (AX) <input type="checkbox"/> Standard type (3a3b, Standatd installation) |  |   | <input type="checkbox"/> Extended type (5a5b) <i>Note 3</i>   |   | <input type="checkbox"/> High capacity (5a5b) <i>Note 3</i> |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                 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|  |  |   | - Key Lock (K1, K3)  |  |   | <input type="checkbox"/> Single key, K1 (ON - Lock)   |   | <input type="checkbox"/> Double key, K3 (ON - Lock)         |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                       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|  |  |   | - Under voltage trip device (UVT, Instantaneous)   |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                      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|  |  |   | <input type="checkbox"/> AC/DC 100V – 130V   | <input type="checkbox"/> AC/DC 200V – 250V           | <input type="checkbox"/> DC 125V                          | <input type="checkbox"/> DC 24V – 30V   | <input type="checkbox"/> DC 48V – 60V                       | <input type="checkbox"/> AC/DC 380V – 480V                  | <input type="checkbox"/> AC 48V                  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                       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|  |  |   | - Mechanical operation contact (MOC), Door Interlock (DI)                                |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |           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|  |  |   | - Mechanical Interlock (MI)  |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                 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|  |  |   | - Counter (C) <i>Note 2</i>  |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                 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|  |  |   | - Miss insertion preventive device (MIP)   |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |   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|  |  |   | - Double shunt coil (SHT2)   |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                 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|  |  |   | - Ready-to-close switch (RCS)  |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |               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| - Trip alarm switch, Manual reset button (AL, MRB)     |  |   |  |  |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                  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| <input type="checkbox"/> Key interlock (K2, ON - Lock) |  |   |  |  |   | <input type="checkbox"/> ON/OFF Button Lock   | <input type="checkbox"/> Temperature Alarm                  |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                        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|  | ACB cradle   | Standard accessory  | <input type="checkbox"/> Safety shutter lock (STL)                                       |  |   |   | <input type="checkbox"/> Zero arc space (ZAS) <i>Note 2</i> |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |    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|  | Separate purchase  | Main body mounting  | <input type="checkbox"/> Insulation barrier (IB)   |  |   |   | <input type="checkbox"/> Slow closing level (SL)            |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |         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|  |  |   | Cradle mounting  | - Cell switch (CL)                                   |   | <input type="checkbox"/> 4C   | <input type="checkbox"/> 8C                                 |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          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|  |  |   |  | <input type="checkbox"/> Door interlock (DI)         |   |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                    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|  |  |   |  | - Mechanical operation contact (MOC)                 |   |   |   | <input type="checkbox"/> Standard type (10a10b)             | <input type="checkbox"/> High capacity (10a10b)  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                      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|  |  |   |  | - Mechanical interlock (MI)                          |   |   |   | <input type="checkbox"/> Wire type (2 terminals)            | <input type="checkbox"/> Wire type (3 terminals) |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                      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|  |  |   |  | - Shortening b-contact (SBC, 4b Max)                 |   |   |   | <input type="checkbox"/> 2b                                 | <input type="checkbox"/> 3b                      |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                      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|  |  |   |  | - Miss insertion preventive device (MIP)             |   |   |   | <input type="checkbox"/> Non-attachment type                | <input type="checkbox"/> Attachment type         |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                      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|  |  |   |  | <input type="checkbox"/> Cradle mounting block (CMB) |   | <input type="checkbox"/> Safety control cover(SC)   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                        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|  |  |   |  | <input type="checkbox"/> Racking interlock (RI)      |   | <input type="checkbox"/> Insulation barrier (IB) <i>Note 2</i>  |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |            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|  |  |   |  | External mounting                                    | - UVT time delay controller (UDC)                         |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                  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|  | <input type="checkbox"/> AC/DC 100V – 130V   | <input type="checkbox"/> AC/DC 200V – 250V  |  |  | <input type="checkbox"/> DC 125V                          | <input type="checkbox"/> DC 48V – 60V   | <input type="checkbox"/> AC 380V – 480V                     | <input type="checkbox"/> AC 48V                             |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          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|  | <input type="checkbox"/> Door flame (DF)   | <input type="checkbox"/> Condenser trip device (CTD)  |  |  | <input type="checkbox"/> OCR tester                       |   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |   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|  |  | <input type="checkbox"/> Dust cover (DC)  |  | <input type="checkbox"/> Profibus-DP Comm. (PC)      | <input type="checkbox"/> Temperature Alarm (TM)           | <input type="checkbox"/> Remote I/O (RCO)   |   |   |  |                          |  |       |  |                   |  |  |      |      |    |                  |             |    |     |                         |                          |          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |                          |                          |                          |                              |                              |                          |                          |                          |                          |       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*Note 1.* In case of D type of AKN, frame size is in the range of 630 – 1600AF  
*Note 2.* The standard accessory for AKH  
*Note 3.* Aux. contact with extended/high capacity type adopts the rapid auto-reclosing method and available up to 6a6b.







● **Headquarters**

AKS Building, 3, Kanda Neribeicho,  
Chiyoda-ku, Tokyo, 101-0022, Japan  
TEL: <81>(3)4345-6000  
FAX: <81>(3)4345-6914

● **Singapore**

**Hitachi Asia Ltd.**

Power & Industrial Systems Group  
24 Jurong Port Road, #03-05 Cwt Distripark,  
Office Block, Singapore, 619097  
TEL: <65>(6305)7400  
FAX: <65>(6305)7401

● **Vietnam**

**Hitachi Asia Ltd.(Ho Chi Minh City Office)**

7th Floor, The Landmark, 5B Ton Duc Thang  
Street District 1, Ho Chi Minh City  
TEL: <84>(8)829-9725  
FAX: <84>(8)829-9729

**(Ha Noi Office)**

Sun Red River Bldg, 6th Floor,  
23 Phan Chu Trinh Street  
Hoan Kiem District Hanoi  
TEL: <84>(4)933-3123  
FAX: <84>(4)933-3125

● **India**

**Hitachi India Trading Pvt. Ltd.**

Hindustan Times House (10th Floor)  
18-20, Kasturba Gandhi Marg., New Delhi, 110001  
TEL: <91>(11)331-5635, 371-2817, -3953, -3958  
FAX: <91>(11)331-3742

● **Indonesia**

**Hitachi Asia Ltd. (Jakarta Office)**

Mid Plaza 1, 10th Floor, J.I. Jend.  
Sudirman Kav. 10-11, Jakarta 10220  
TEL: <62>(21)574-4313  
FAX: <62>(21)574-4312

● **Malaysia**

**Hitachi Asia (Malaysia) Sdn. Bhd.**

Suite 17.3, Level 17, Menara IMC (Letter Box No.5)  
No. 8 Jalan Sultan Ismail, 50250, Kuala Lumpur  
TEL: <60>(3)201-8751  
FAX: <60>(3)201-8757, -8758

● **Philippines**

**Hitachi Asia Ltd. (Philippines Branch)**

25th Floor, Pacific Star Building, Cor. Makati & Sen. Gil.  
Puyat Ave., Makati, Metro Manila  
TEL: <63>(2)819-7528, -7529  
FAX: <63>(2)819-7539

● **Thailand**

**Hitachi Asia (Thailand) Co., Ltd.**

18th Floor, Ramaland Building, 952 Rama IV Road  
Bangrak, Bangkok 10500  
TEL: <66>(2)632-9292  
FAX: <66>(2)632-9299

● **China**

**Hitachi East Asia Ltd.**

4th Floor, North Tower  
World Finance Centre, Harbour City  
Canton Road, Tsim Sha Tsui, Kowloon  
Hong Kong  
TEL: <852>2735-9218  
FAX: <852>2375-3192

**Hitachi China Ltd. (Beijing Office)**

Room 1412, Beijing Fortune Building  
5 Dong San Huan BeiLu  
Chao Yang District, Beijing 100004  
TEL: <86>(10)6590-8851, -8852, -8853, -8854  
FAX: <86>(10)6590-8850

**Hitachi (Shanghai) Trading Co., Ltd.**

18th Floor, Rui Jin Building,  
No.205, Maoming Road(S)  
Shanghai, 200030  
TEL: <86>(21)6472-1002  
FAX: <86>(21)6415-8272

● **Taiwan**

**Taiwan Hitachi Asia Pacific Co., Ltd.**

3rd Floor, Hung Kuo Building No.167  
Tun-Hwa North Road, Taipei (105), Taiwan  
TEL: <886>(2)2718-3666  
FAX: <886>(2)2718-8180

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